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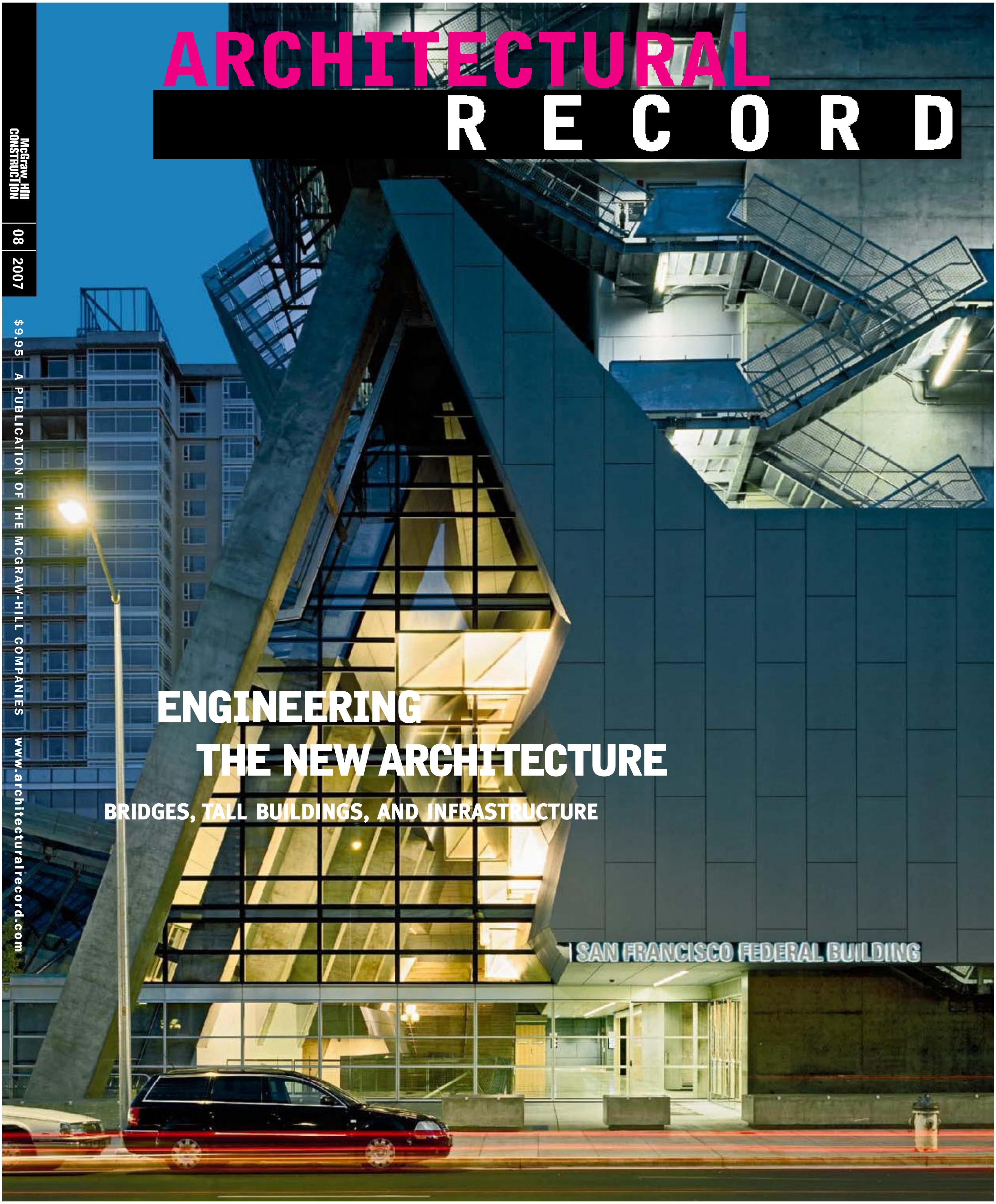
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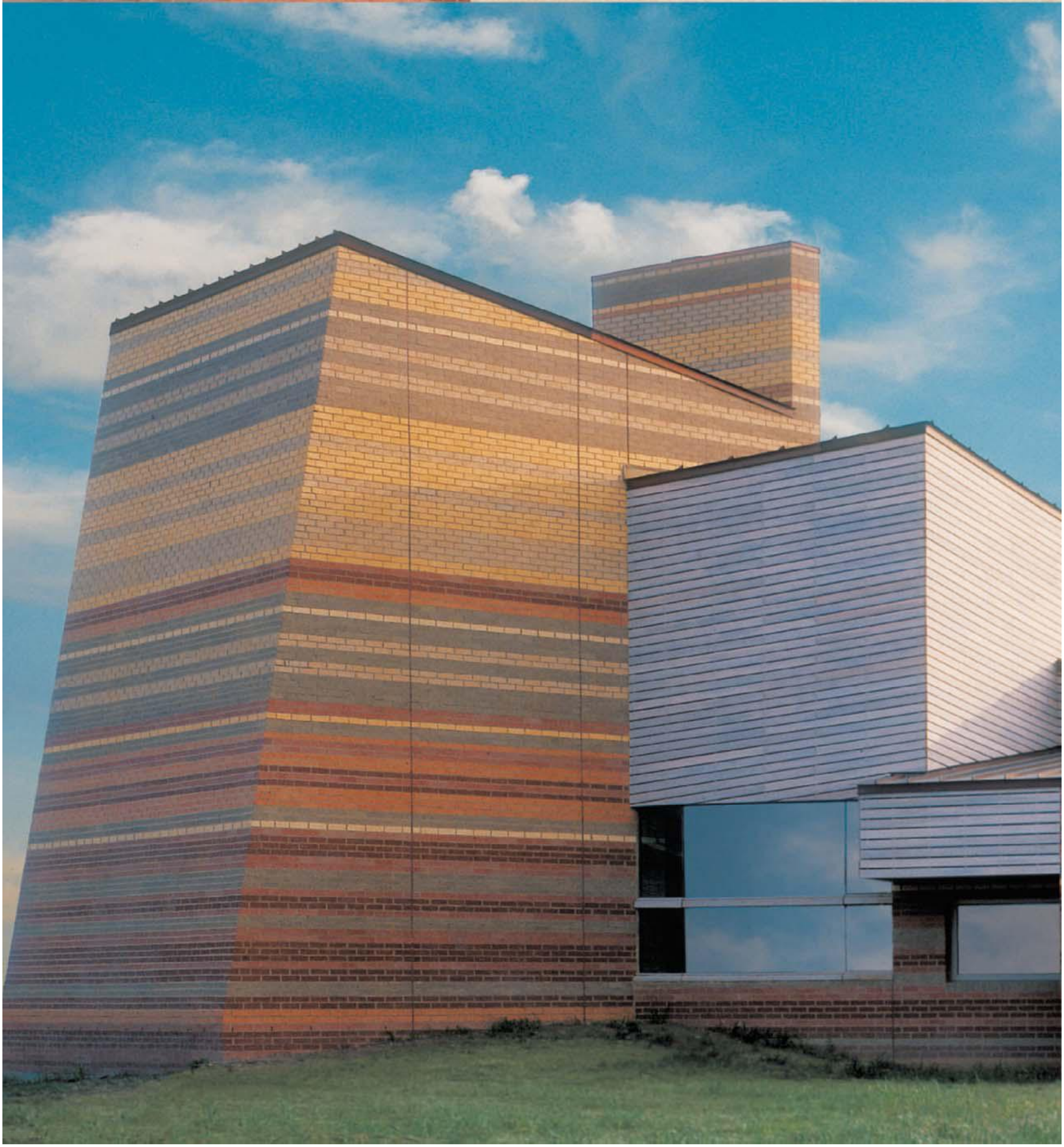

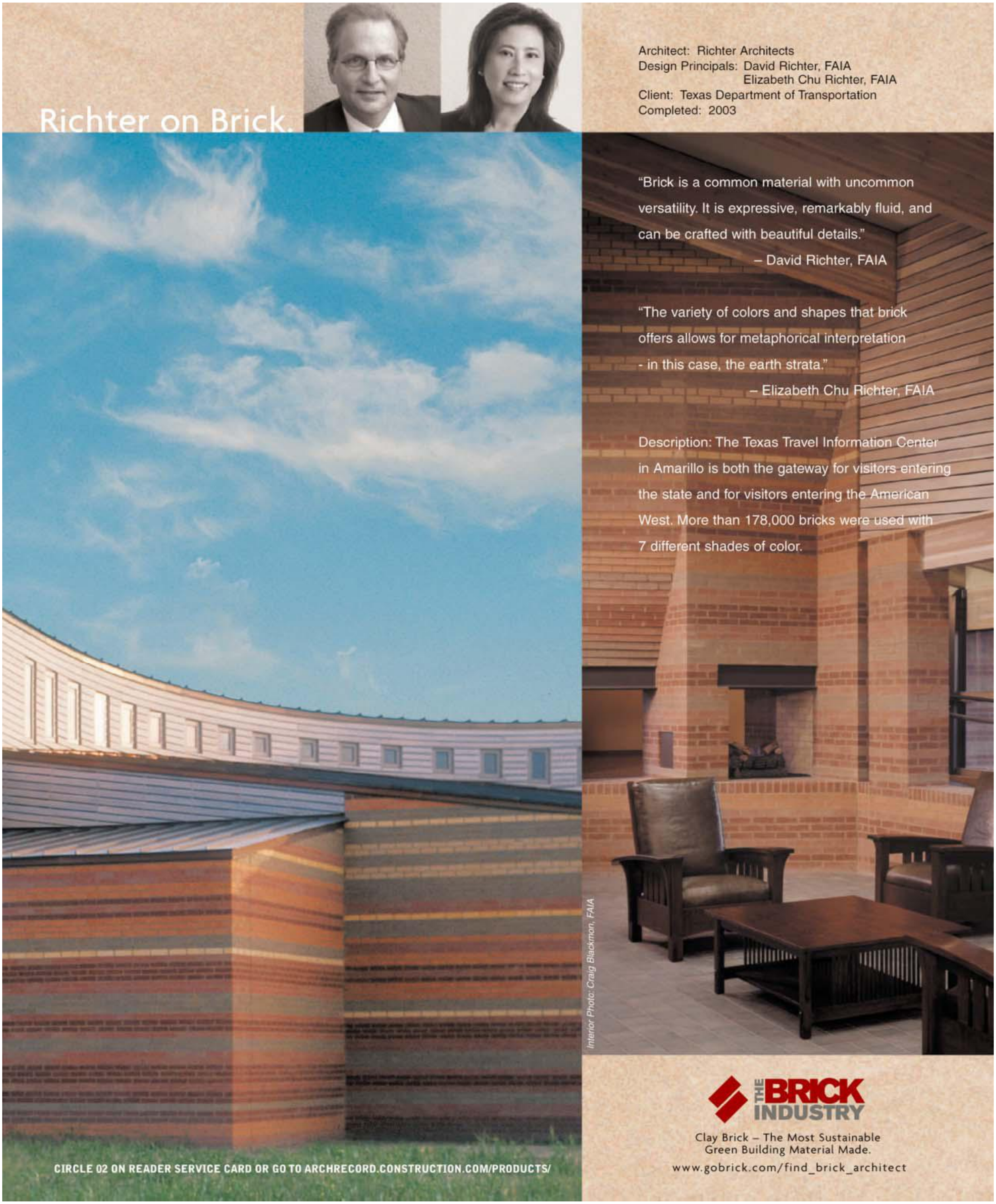

Richter on Brick.

Architect: Richter Architects
Design Principals: David Richter, FAIA
Elizabeth Chu Richter, FAIA
Client: Texas Department of Transportation
Completed: 2003

"Brick is a common material with uncommon versatility. It is expressive, remarkably fluid, and can be crafted with beautiful details."
– David Richter, FAIA

"The variety of colors and shapes that brick offers allows for metaphorical interpretation - in this case, the earth strata."
– Elizabeth Chu Richter, FAIA

Description: The Texas Travel Information Center in Amarillo is both the gateway for visitors entering the state and for visitors entering the American West. More than 178,000 bricks were used with 7 different shades of color.

Interior Photo: Craig Blackmon, FAIA

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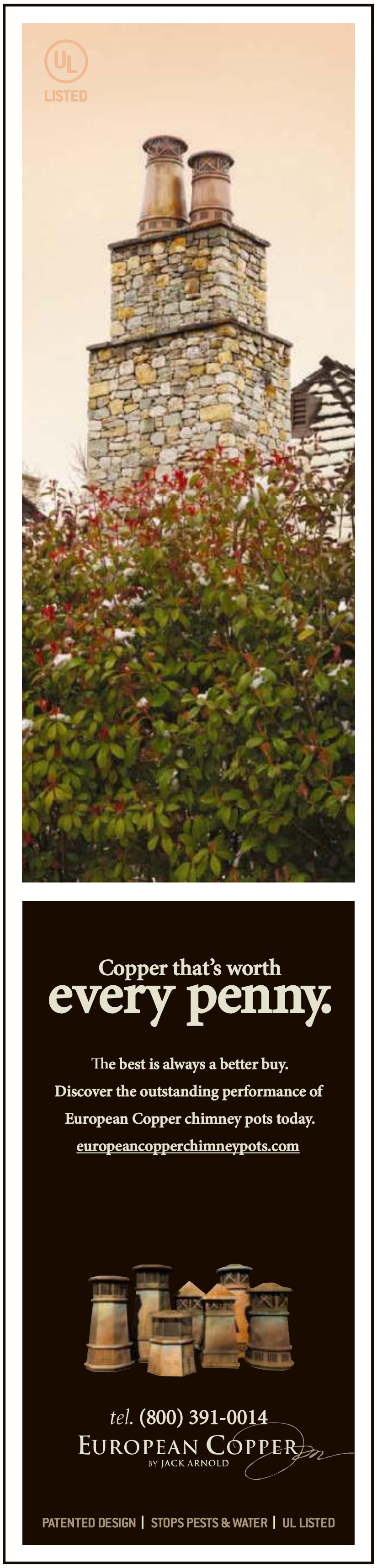

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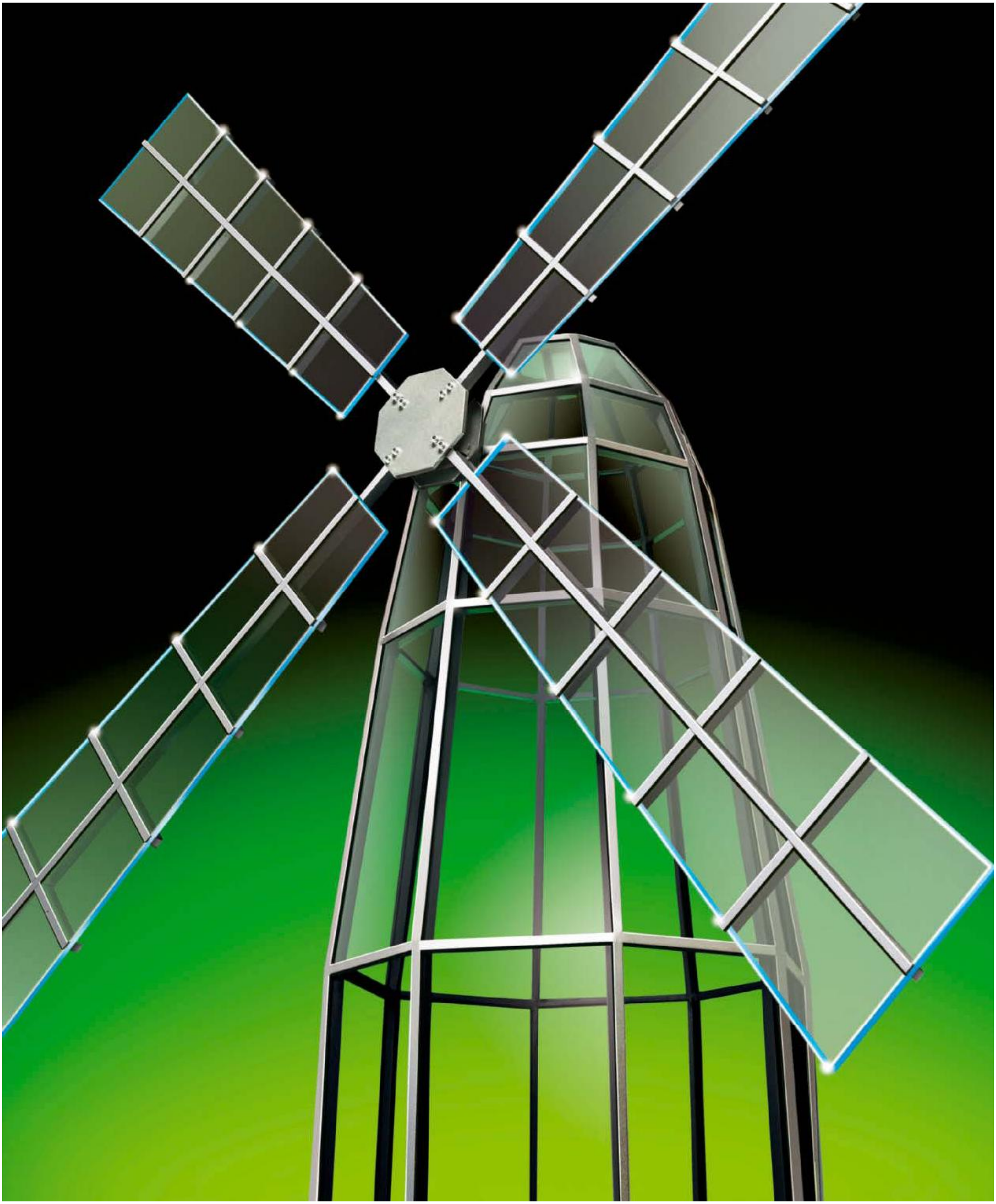

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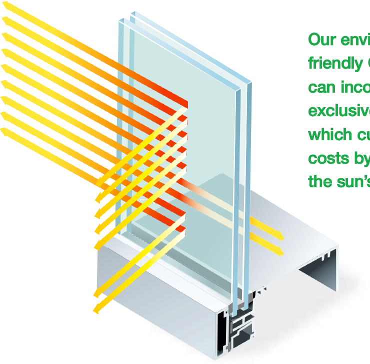

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Courtesy of CENTRIA

Company business model emphasizes working with building teams "upstream" in the design process

CENTRIA Contributes to Building Teams

What makes a building team member valuable? For CENTRIA—the U.S.'s premier supplier of architectural metal wall and roofing systems—the secret is turning the "what if" into "what is." This is accomplished through a dedication to quality, aesthetics and strong working relationships with architects, owners and contractors alike. Over the course of CENTRIA's rich history, the company has come to realize how these components work together to make them the leader in the design, engineering and manufacturing of architectural metal wall and roofing systems.

Working "Upstream"

No building project can ever be executed without the work of building teams. As such, CENTRIA believes in working in concert with architects, owners and contractors throughout the entire building process, from design concept to installation and erection. Close collaboration ensures everyone has a firm grasp on cost data, product specifications, design capabilities and installation methods. This widespread integration early on saves time and money in the long run and often sparks creativity as multiple minds working together are always better than one. By embracing this "working upstream" philosophy, CENTRIA has helped turn architects' visions into realities.

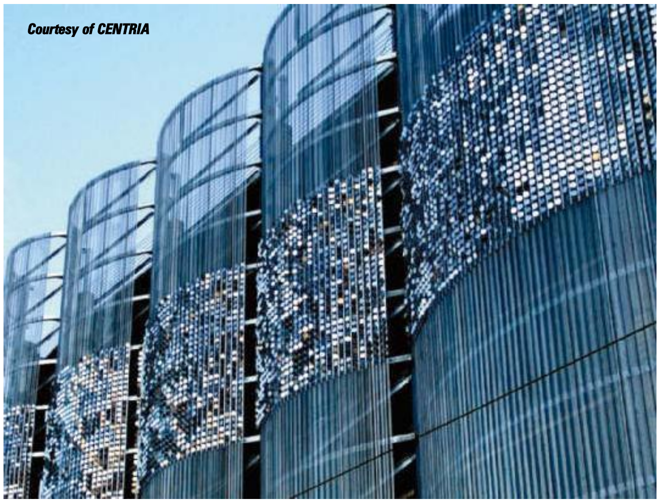
Customer Inspired Products = Quality

CENTRIA's wall and roof systems are manufactured in Arkansas and Kentucky plants and its two coating plants, located in Pennsylvania and Ohio, are capable of applying most coatings in virtually limitless color selections. The company is lauded for providing quality, versatile materials while always exploring new possibilities. Many of these products are a direct result of collaborative efforts with the building teams mentioned above.

For example, CENTRIA's Formawall® Dimension Series® metal wall panels were inspired by listening to building teams (typically through conducting surveys and focus groups) who sought a product offering aesthetic customization, versatility and great

---

TOP: The Guthrie Theater, located in Minneapolis, MN, highlights CENTRIA's Formawall™ Dimension Series® metal panels & Formavue windows. Both products further enhance the integration of the theater with the industrial building landscape of the Mississippi waterfront.
Project Designer/Architect: Ateliers Jean Nouvel; Architectural Alliance



Courtesy of CENTRIA

CENTRIA's EcoScreen™ perforated screenwall, a unique metal wall application, was used to provide air movement, light control and security on the ITC Parking Deck in Charlotte, NC.
Project Designer/Architect: Little Diversified Architectural Consulting with Ned Kahn

performance. This product line addresses all of these needs as the only wall system providing both advanced thermal efficiency and moisture control in a single panelized component. It also offers the strength and durability to withstand drastic climate changes while still providing designers virtually unlimited aesthetic options in terms of form, color and texture.

Similarly, CENTRIA's Formawall® Graphix Series® metal wall panels were designed with building teams in mind, allowing the multi-panel designs envisioned by architects with single panel performance. Graphix Series is a single wall panel made to look like several smaller panels. This unique segmented construction makes the desired performance achievable and installation economical, while still allowing designers unlimited combinations of new design possibilities.

Award Winning Innovation

CENTRIA's wide array of quality products didn't happen overnight. It was formed, in 1996, by bringing together the former E.G. Smith Construction Products, Inc., Steelite, Inc., and H.H. Robertson companies. As CENTRIA, the company offers more than a century of combined experience in engineering, manufacturing, and constructing nonresidential, architectural, industrial, and institutional metal buildings.

One of the company's most notable building construction breakthroughs was the foamed-in-place metal wall system which provides superior thermal performance and protection against moisture and air infiltration. Today the company's research and development of Advanced Thermal and Moisture Protection (ATMP) systems is leading the architectural metals industry in effective air, water and moisture protection. In addition, these systems offer an aesthetically pleasing surface, as well as efficient installation.

CENTRIA also invests in providing AIA Continuing Education System credits, as well as product training for building teams to help all parties understand why its products are designed the way they are—all part of a collaborative process.

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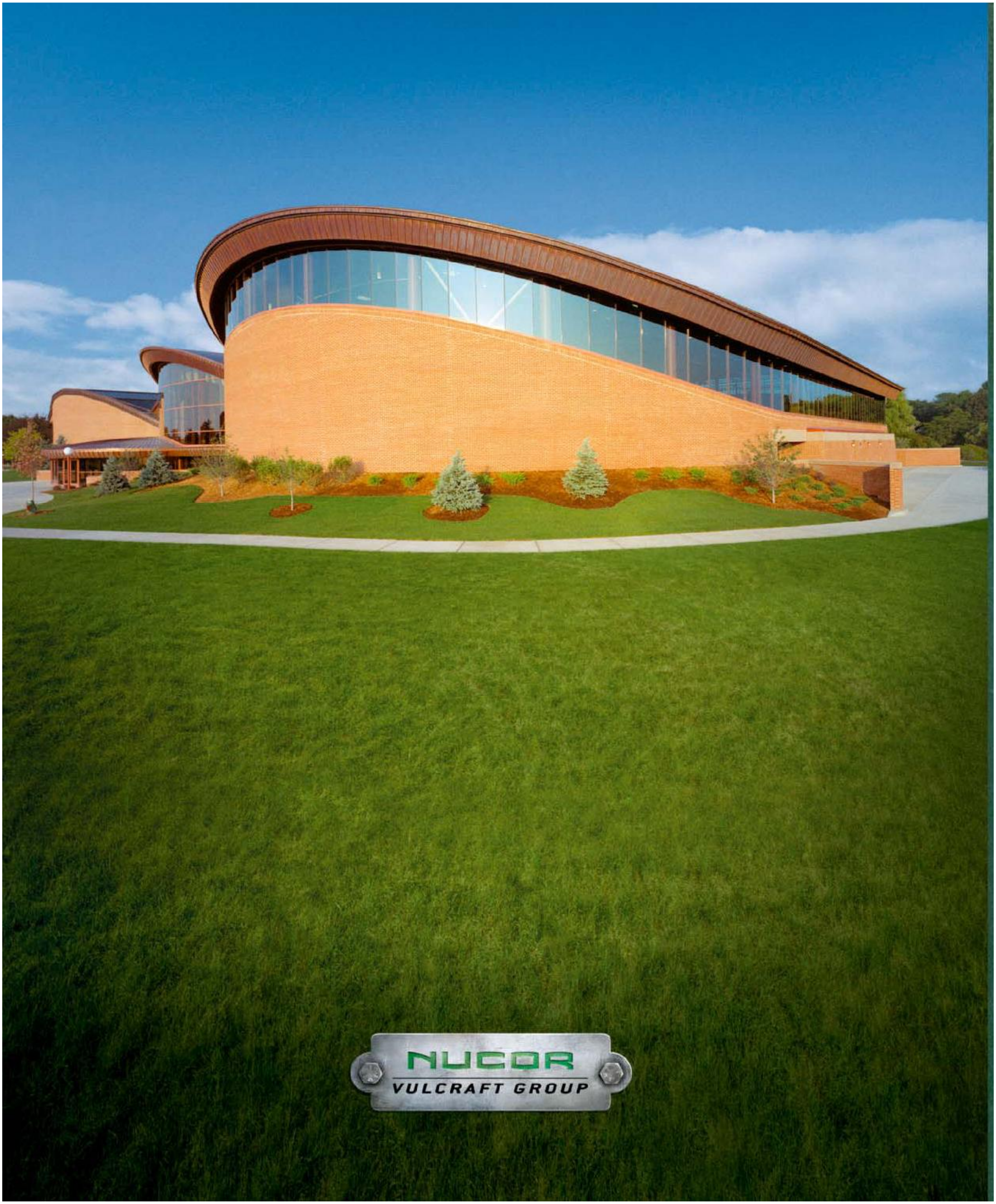

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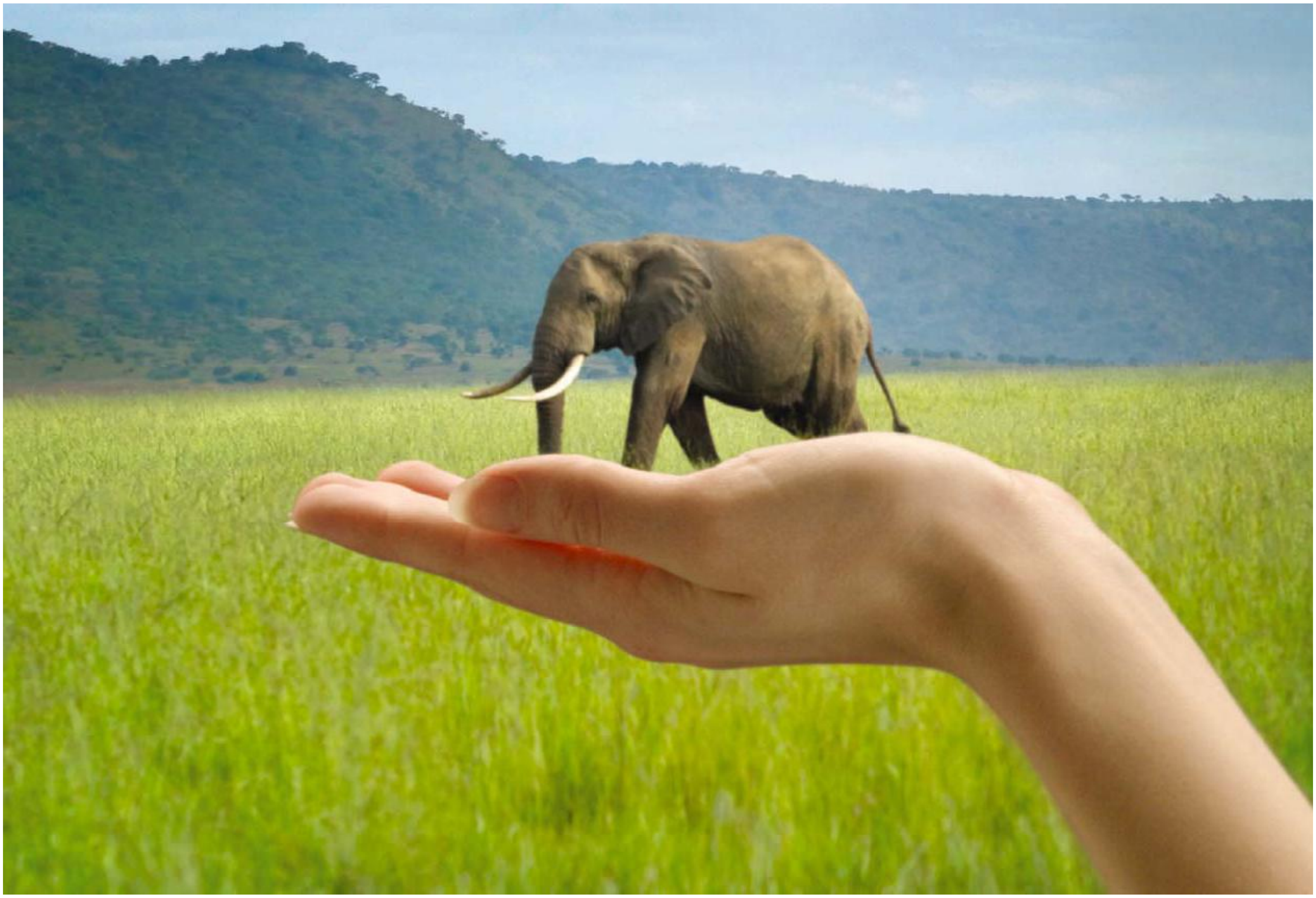

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08.2007

On the Cover: *U.S. Federal Building, by Morphosis. Photograph by Roland Halbe.*
Right: *Suvarnabhumi Airport, by Murphy/Jahn. Photograph by Rainer Viertlboeck.*

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building types study: tall buildings

Unresolved issues not withstanding, we are awash in new skyscrapers. But the typology's reenergized career banks on one of two design strategies: go really tall or technologically dazzle—like Sports City Tower in Doha (left). Exclusively online, we present eight tall buildings that prove our point.

project portfolio

The "spectacular" architecture routinely featured in RECORD and on architecturalrecord.com relies more than ever on the ingenuity and creativity of the contemporary engineer. San Francisco's Federal Building (left), Bangkok's airport, Portland's aerial tram, and Lufthansa's Frankfurt headquarters all embody the principles of the new engineer.

lighting section

Designers of architectural lighting are redefining buildings' necessary connective tissue with moments of poetry and delight, such as the installation at Wu Jiao Plaza, Shanghai (left). While their makers' motivations differ, these three featured projects underscore infrastructure's artistic potential.

community

photo gallery

View more than a thousand images submitted by readers from all over the world in 10 categories, such as Residential and Green Projects (right two). You can also send us your own photos at construction.com/community/gallerylist.aspx.

blogs

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forums

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comments

"I'm glad to see that architecture is finally coming alive in Harlem. The neighborhood is so unique and elegant, and now the architecture is truly going to reflect that uniqueness—bravo!"

and more ...

residential: house of the month

Exclusively online: A small guesthouse by Waggonner & Ball Architects (below), done as a modern version of the dog-trot prototype, becomes the main course, as the clients fall in love with the home and decide it's just right for weekend escapes.

archrecord2

A young architect takes Manhattan with her firm, Studio ST, while students in New Orleans take on the housing crisis in their damaged city with URBANbuild. Both are finding the right housing solutions for their chosen clients. At architecturalrecord.com/archrecord2/ you can learn about other inspiring designers in Design, Work, Live, and add your opinions in Talk. Only online: Is submitting to international competitions worth the effort for young U.S. firms? Let us know what you think by responding at construction.com/community/forums.aspx.

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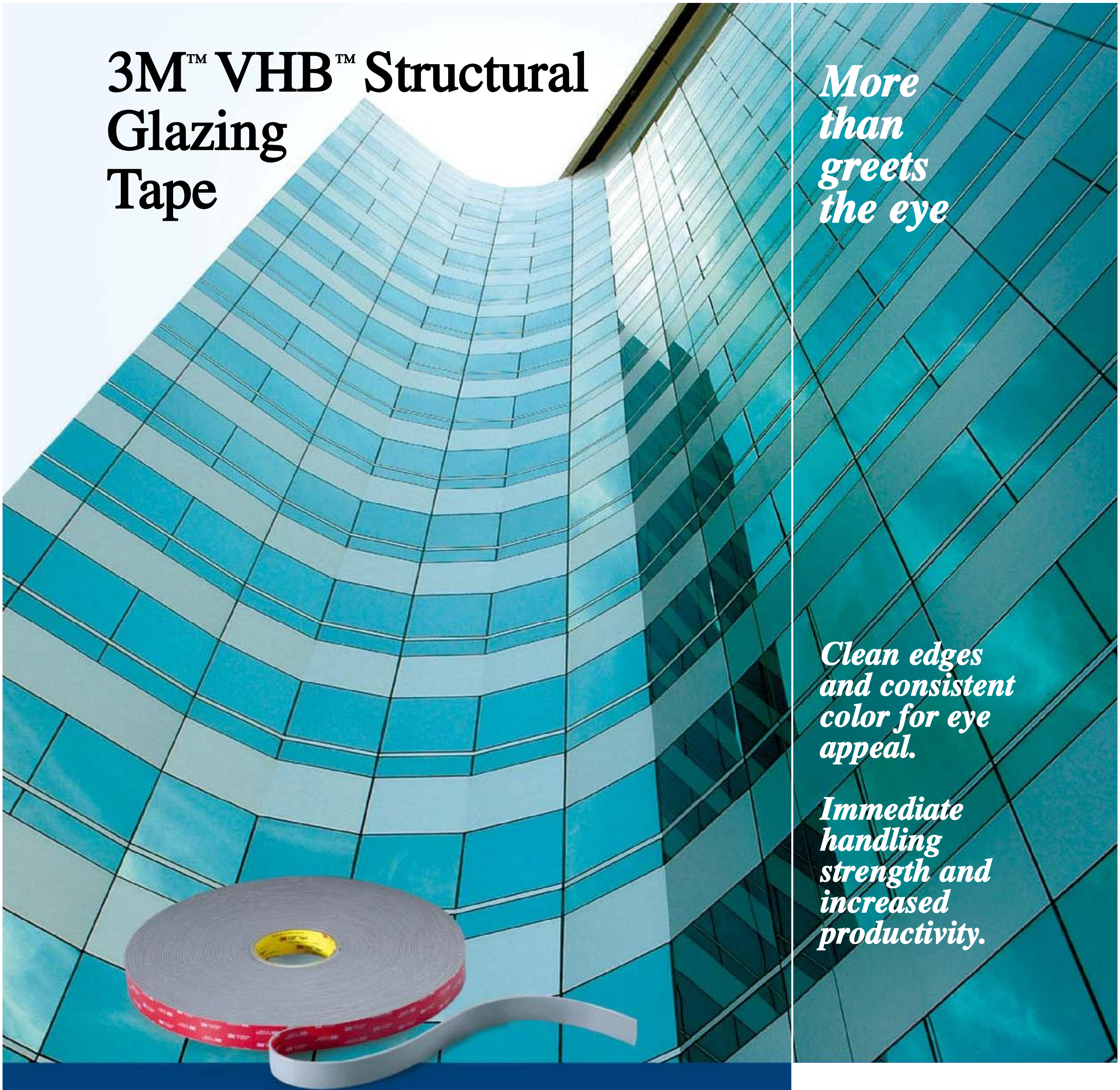

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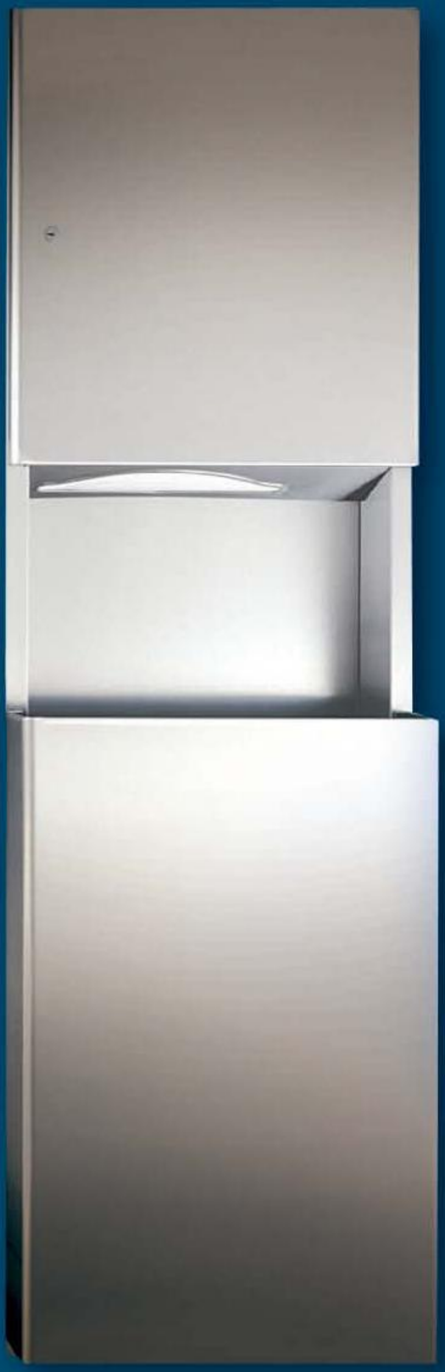

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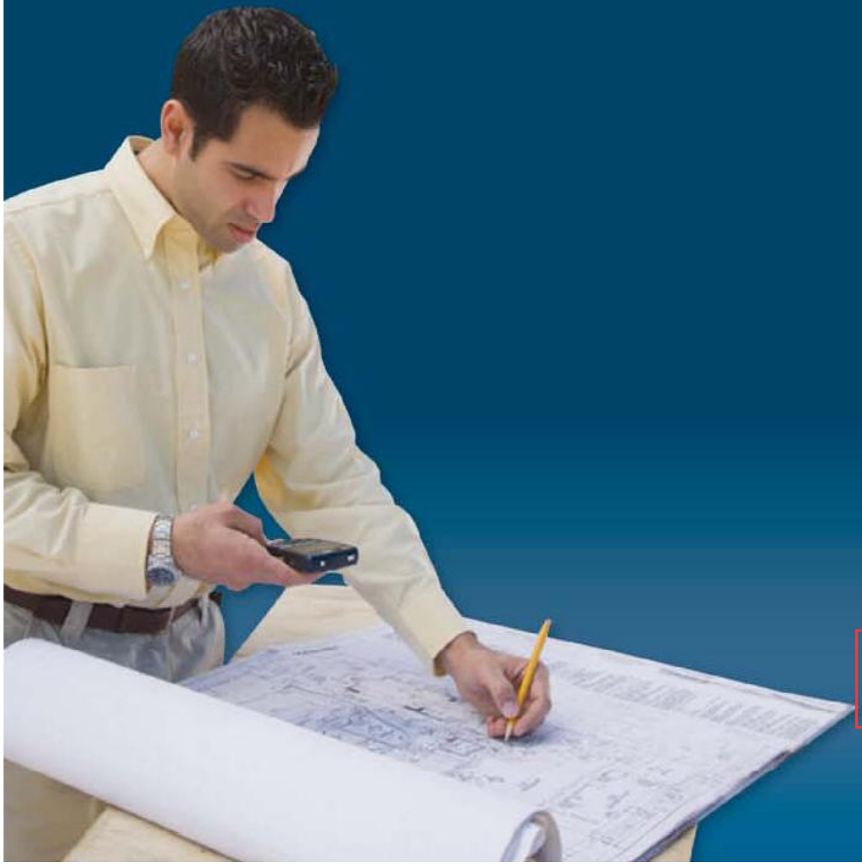

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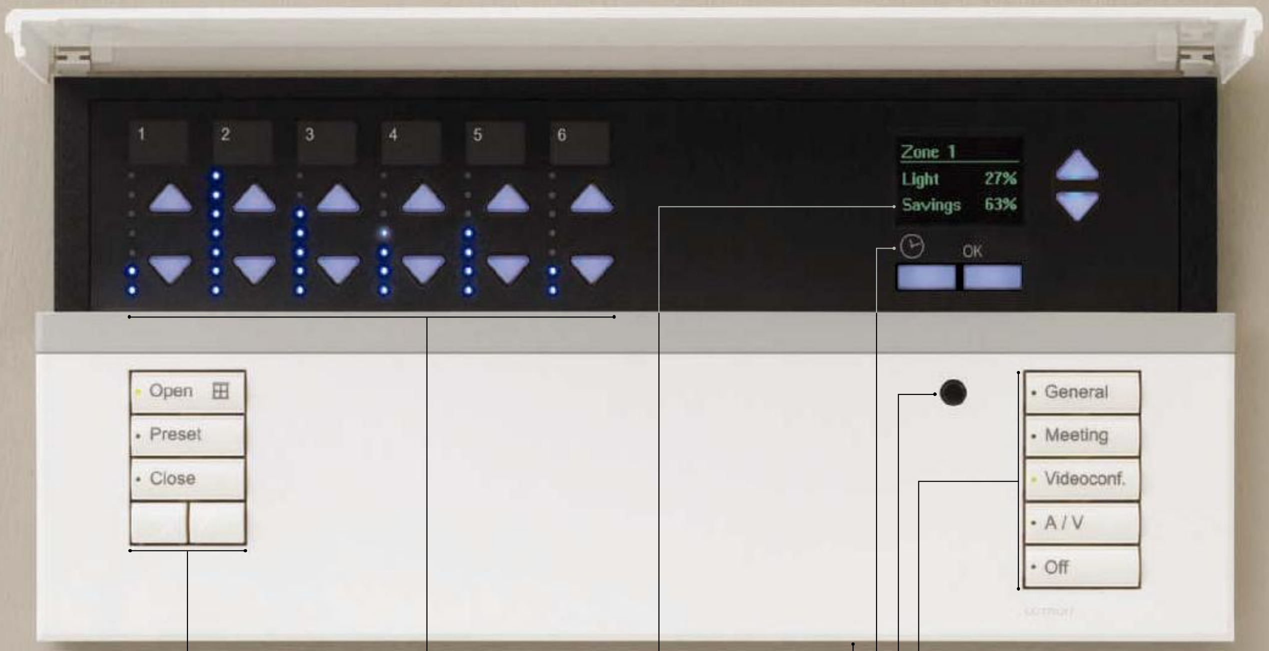
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The last word

Editorial

By Robert Ivy, FAIA

In the 18th century, Dr. Johnson asserted the critic's role to skewer "delusive combinations, and distinguish that which may be praised from that which can only be excused." Excuse me! In the linked-in, blog-bursting 21st century, aren't we all critics? Thankfully, the distinctions of language, between "gourmet" and "gourmand," hold fast, and some writing still warrants savoring, not merely devouring.

Since the mid-1980s, Martin Filler has contributed a medley of long critical essays on architects and architecture to The New York Review of Books. *A new book by that publisher released on July 17 collects and updates Filler's essays in a single offering entitled* Makers of Modern Architecture: From Frank Lloyd Wright to Frank Gehry. *Arriving in time for the dog days, Filler provides something to sink our teeth into. Delicious!*

Uniquely, his collection features the author's textual critique (responding to the written matter of other critics, the architect him/herself, curators, or writers), and his reviews of exhibitions and their accompanying texts, as much as reflections on any one architectural project. Filler's essays consist of a rich amalgam of biographical analyses, emphasizing each individual's career trajectory, with some formal analysis of the architects' built work. Refreshingly, he avoids too much of the latter, preferring to delve into matters often unexplored in the popular press. Along the way, we encounter quotable quotes, aperçus, digressions, obsessions, professional sympathies, categorizations, personal prejudices, pronouncements, analogies, refutations, as well as political and social observations, and a rich, fulsome exercise of the English language.

In our superficial era, when architectural criticism gasps for column inches in the newspapers, and blogs woefully lack erudition or research, Filler's assessments in The New York Review *stand apart, eschewing fashion and offering polished, carefully edited and backed-up, though highly personal, assertions. If his subjects seem more familiar than the architect du jour, comprising a selective roster of 20th-century masters, Filler's razor-sharp mind and sharper tongue set him apart. We gobble up what he thinks, as well as how he serves it up.*

For those seeking a point of view, he rarely disappoints: Strong opinions pepper almost every page. Filler's admiration and approbation go to architects like Sullivan who search for, and occasionally attain, higher social and philosophical ideals. Wright was "the supreme master builder of the 20th century." Mies gets a multicolored assessment, both revisionist and admiring, as a thwarted heroic figure, whose followers could not match the master's own gifts. Aalto remains "the most underappreciated giant of the Modern Movement." Filler's insight on Louis Kahn, whom he declares with the assurance of Miss Jean Brodie extolling Giotto, "the world's leading midcentury architect" (could you say that?), includes the historian Vincent Scully's role in promoting Kahn's work. He (Scully) "needed a present-day hero to fit his narrative."

Sometimes the critic tilts too deeply into a specific conversation better answered elsewhere, and thereby illustrates one of the weaknesses of the book: Our expectations exceed the essays, which were originally conceived for another audience at the more temporal Review*—an assertion particularly evident as we read Filler on Berlin's Reichstag, here conflated into a discussion of the city and the architect Norman Foster. Never mind. We read on.*

Gleefully, the critic relishes a genuine disembowelment—with an aim at eviscerating Samuel Johnson's aforementioned "delusive combinations"—such as the excesses of Postmodernism, or the ersatz Modernism that occurred in the wake of the International Style. Like many social critics, Filler hates cronyism and sycophants of any stripe, particularly certain architects and fellow critics guilty of such venality. He gets the last word.

Philip Johnson sits squarely in his sights for some of those reasons. One chapter begins: "If, as the philosopher Francis Bacon wrote, 'The monuments of wit survive the monuments of power,' … then Philip Johnson might be remembered by future generations after all."

Filler derides Johnson's personal qualities ("born salesman" and "glib improviser," as well as a Nazi sympathizer who got off light) as those of a man who changed his architectural styles as if changing a suit to match the moment. Johnson, his intimate circle, and the Museum of Modern Art, an institution in which Johnson held formidable power, form subtexts throughout the book, appearing in several essays, clearly a fascination, if not minor obsession, of this New York–based writer.

Whom does he list or leave out? In the course of 300 pages, he engages 17 architects, including the Eamseses (positive review) and Calatrava (less sanguine), but manages to omit Robert Stern, Peter Eisenman, and Michael Graves, all 1980s rock stars, as well as a shopping list of current galactic lights such as Zaha Hadid, Rem Koolhaas, Jean Nouvel, and Thom Mayne. You might wish for a more complete overview, as gossipy and fact-filled, as anecdotal and opinionated as this book can be. Too idiosyncratic a taste? Too hot? Some will spit it out. Ultimately, Filler's engaging book entertains and informs as it opines; then the language ceases, leaving us hungering for more of this piquant, yet savory intellectual dish.

Robert Ivy

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Letters

Seeing the light

I was astounded to behold the cover of your July 2007 issue. It wasn't the architecture, although that was reasonably attractive: another Post Form Z building featuring people along a faceted wall that glowed white against the night sky. In fact, I wouldn't have noticed the basic problem if it wasn't trumpeted by a tag line that took my breath away for its insensitivity: "Steven Holl lights up the skies of Kansas City."

Excuse me?! How out of touch can RECORD be? With all due respect to the work of a renowned architect, I cannot imagine a more regrettable comment given the concerted efforts worldwide to end light pollution. How is it that a leading publication would glorify the one aspect of a particular work that is perhaps better left alone? Allow me to suggest a look at DarkSky.org. Sustainable design is no longer a fringe movement or a passing fad. As a prominent publication, try to be a little more conscious about what's worth passing on to our fellow architects and, indeed, our children.

—Joseph Cincotta, AIA
Wilmington, Vermont

Gaining from loss

I am writing to express my admiration for many of the thoughts conveyed in Robert Ivy's June editorial, "Interpretive" [page 23], especially the need for understanding the value of—and acting to preserve—Modern architecture. I was shocked to learn of the demolition of Rudolph's Micheels House this spring under circumstances similar to those of Wright's Little House II. As we have witnessed time and again, it often takes a major architectural loss to breed appreciation, but it is truly unfortunate when such lessons do not carry forward. As Ivy states, many works of Modernism are, as yet, underappreciated in terms of preservation. Thankfully, organizations such as Docomomo go a long way in drawing attention to this situation, as do Ivy's fine "Interpretive" editorial and the magazine's "Historic Encounters" issue.

—Debra Pickrel
New York City

Rousing the critic

Robert Campbell's "Critique" in the July 2007 issue ["Calling a truce in the style wars over government buildings," page 53] is depressing and disappointing. The role of the critic is to shape opinion, not avoid it—doubt must be left to the artist. Campbell's view borders upon nihilism and does not advance our understanding of the current state of architecture.

—James A. Gresham, FAIA
Tucson

Corrections

A news story about memorials [July 2007, page 34] failed to mention that Ghiora Aharoni partnered with Stamberg Aferiat Architecture to design a 9/11 memorial for St. Vincent's Hospital in Manhattan. The story also mischaracterized the Logan Airport memorial as being focused around a "Palace of Remembrance." It should have read "Place of Remembrance."

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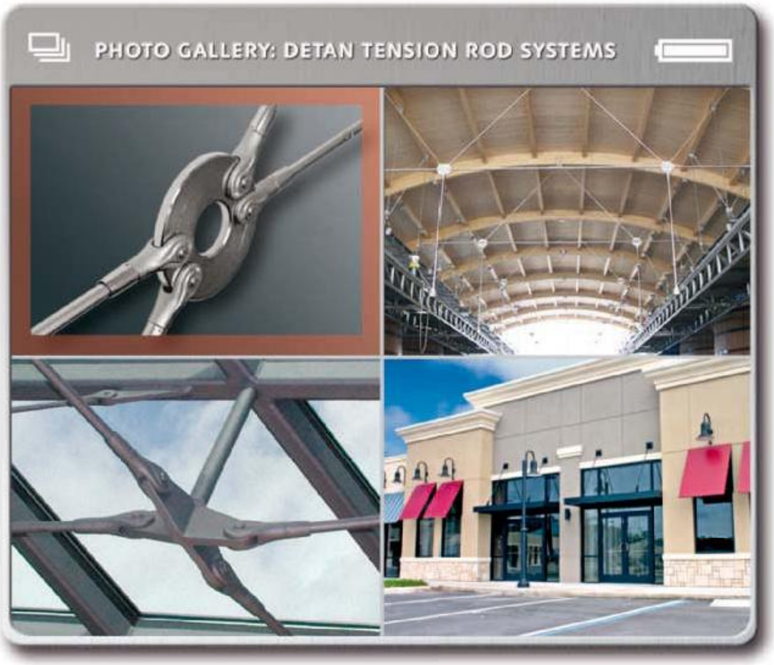

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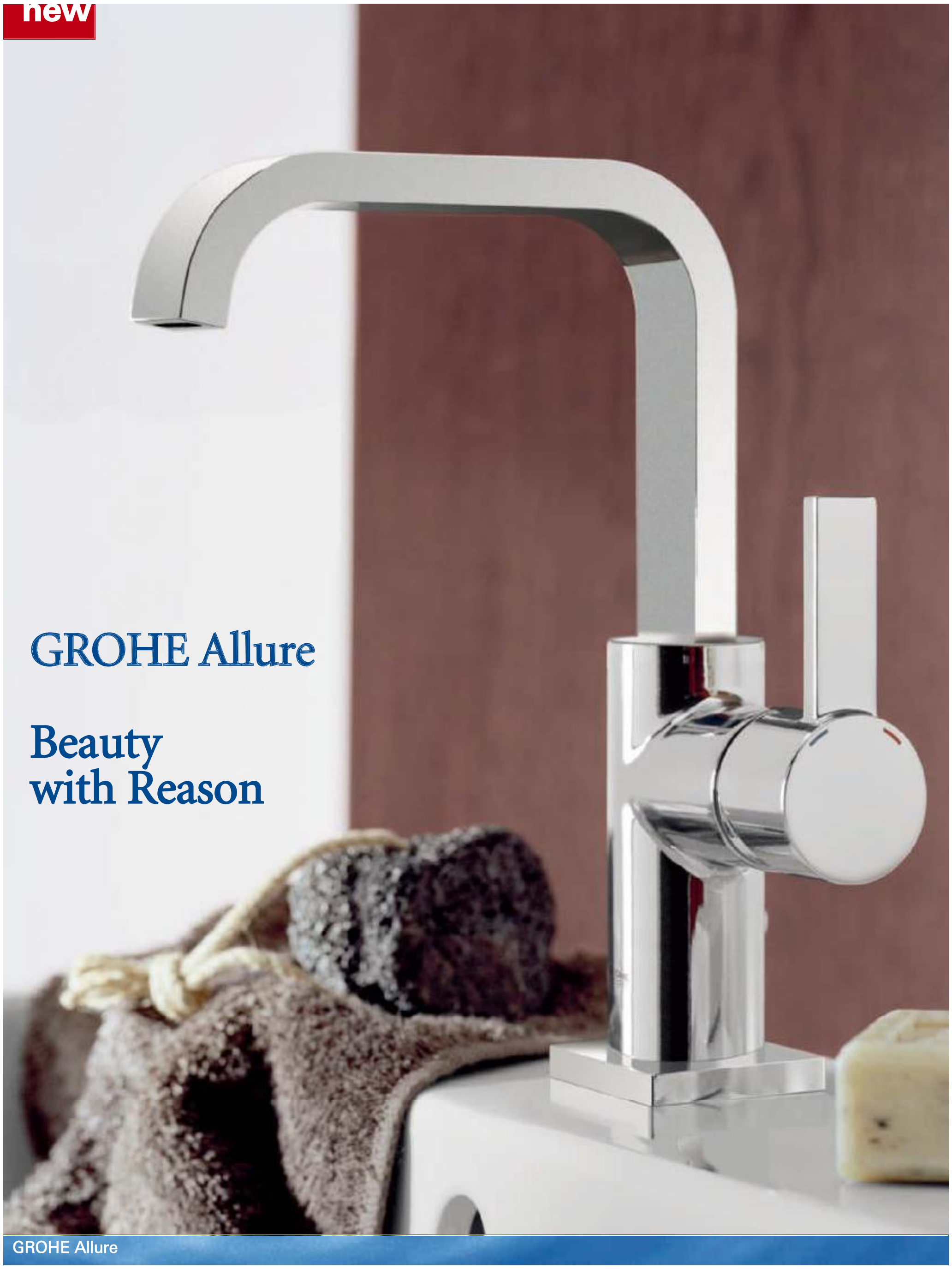

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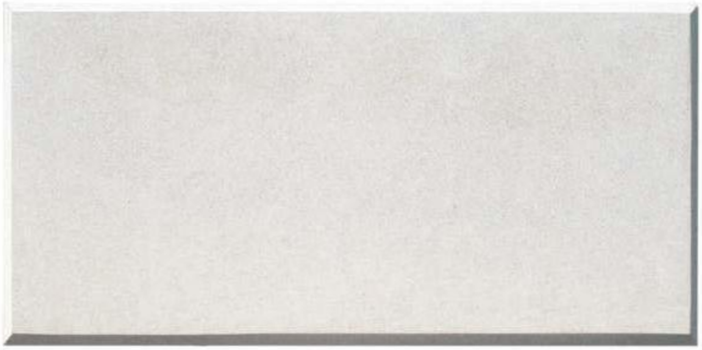

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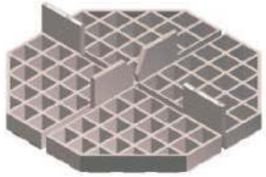

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Blood, sand, and tears: Worker abuse alleged in the U.A.E.

PHOTOGRAPHY: © MICHAEL GOODMAN

The remarkable development boom in Dubai and Abu Dhabi, both located in the United Arab Emirates (U.A.E.), is completely transforming these cities' skylines and attracting the world's top architects. But it is also exacting a serious cost. Human Rights Watch (HRW) alleges that the migrant workers vital to constructing these projects are subject to "abusive labor practices"—and architects, it contends, are complicit in the problem.

In a report titled "Building Towers, Cheating Workers," published last November, HRW catalogued a host of abusive practices including nonpayment of wages, squalid or dangerous working and living conditions, and the denial of proper medical care. It stated that in 2004 alone, more than 800 construction workers died out of an estimated 2.7 million—although the government claimed only 34 deaths that year. In comparison, the U.S. Department of Labor tracked 1,186 fatalities out of roughly 9 million workers in 2005.

Most laborers in the U.A.E. come from South Asian nations including Bangladesh, India, and Sri Lanka. Many find work by taking expensive loans, averaging $2,000 to $3,000, from recruiting agencies in their home countries—and then devote most of their wages to paying off these advances. Employers in Dubai often pay far less than promised, HRW alleges, and most hold workers' passports for leverage. The average worker earns $175 per month.

Hadi Ghaemi, who authored the HRW report, says that exact statistics are almost impossible to find because the U.A.E. releases little data, but that the government's own figures indicate more than 20,000 migrant workers have filed complaints about the nonpayment of wages and "labor camp" conditions. Workers have also staged riots. In March, at the site of Skidmore, Owings & Merrill's Burj Dubai (photos above), hundreds of frustrated laborers smashed cars and ransacked offices, causing an estimated $1 million in damages, according to The Associated Press.

Nicholas Labuschagne, an adviser to the U.A.E. government and an executive at Dubai Holding, one of the country's key investment firms, says that the U.A.E. is addressing these problems. "[U.A.E. Prime Minister] Sheik Mohammed is embarrassed by the criticism that the labor issues have drawn," he says. "We're hoping we can show some very significant progress within the next six months."

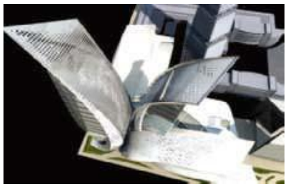
Since 2006, Labuschagne notes, the U.A.E. Ministry of Labor has conducted 83,000 inspection visits, resulting in sanctions against 6,000 firms for job-site violations, and has suspended work permits at 1,300 businesses due to the nonpayment of wages. Moreover, the government has hired 2,000 more inspectors, who are now being trained, and is developing a new center to track labor statistics, including worker injuries and deaths. And to combat unscrupulous recruiting agencies, the U.A.E. is developing agreements with nearby countries to ensure that all workers fully understand their contracts before being granted work visas.

Despite these steps, the main sticking point remains labor organizing, which Labuschagne says is a thorny security issue in a country where the estimated 2.7 million immigrant laborers rivals the size of a native-born population of 4.5 million people; in Dubai alone, there are almost 1 million migrant workers, compared to 1.4 million residents. In February, the U.A.E. released the draft of a revised labor law requiring companies to pay for workers' health care and employment permits, and requiring improvements in construction-site

(continued on next page)

ON THE BOARDS

Nadel Architects, based in Los Angeles, designed a 2.3-million-square-foot office and retail complex for the King Faisal Foundation, in Riyadh, Saudi Arabia. Its four glass towers, sheltered by perforated aluminum sunscreens, curve apart like flower petals—embracing, rather than challenging, Faisal's original building nearby, designed by Foster + Partners. *David Sokol*



Zaha Hadid Architects' Opus, a 921,832-square-foot office and retail complex in Dubai, consists of three 305-foot-tall towers that appear as a single cube pierced by a 98-foot-wide "free-form void that has been eroded from the solidity of the building," Hadid says. *Tony Illia*

Joachim Hauser, a German aerospace architect, has designed Hydropolis, a 1.1-million-square-foot hotel to be located 20 feet below sea level off the coast of Dubai. The curvy structure lacks "harsh architectural design components of land-based edifices," Hauser says. *Dianna Dilworth*

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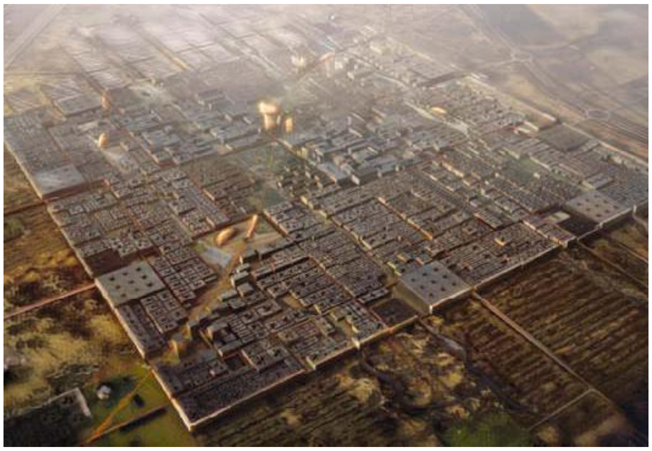
Foster's Masdar City more than a mirage?



Foster + Partners is designing the world's first zero-carbon, zero-waste city in Abu Dhabi. Named Masdar City, which means "the source," the 1,483-acre project will include commercial and manufacturing space dedicated to developing ecofriendly products, housing, a university, and the headquarters for Future Energy Company, which is spearheading the initiative.

Although the desert might seem an unlikely location for such a large sustainable undertaking, Masdar will tread lightly on the landscape by harnessing solar power and relying on construction features that resist high temperatures, including extra shading and slab cooling. Its design is rooted in the Arabic tradition of walled cities—but Masdar's stone-and-mud walls will be covered in photovoltaic panels capable of generating 130 megawatts. Along the site's northern edge, the walls will be more permeable to let in breezes. Electricity will also come from photovoltaic cells integrated into rooftops and a 20-megawatt wind farm. The city will get its water from a solar-powered desalination plant.

Since Masdar will be car-free, shaded paths will make walking more bearable in the region's extreme climate. Land surrounding the city, which is 20 miles outside the center of Abu Dhabi, will contain wind and photovoltaic farms, as well as research fields and plantations that will supply crops for the city's biofuel factories. These fields will also help reduce waste by acting as carbon sinks to offset gases produced in the factories—and they will be irrigated with gray water drawn from the city's water treatment plant.

Masdar will be developed in phases centered on two plazas. The first stage includes construction of a 60-megawatt photovoltaic power plant that will supply electricity for constructing the rest of the city. This will be followed by a 130-acre main square. Foster finished the initial phase of master planning this spring. The project's engineers include E.T.A., which is overseeing the renewable-energy components; Transsolar; WSP Energy; and Flack + Kurtz. Designers estimate that it will take 10 years to build out the entire city, with structures ultimately occupying nearly half of the site. When complete, Masdar will be home to 45,000 people and attract an additional 60,500 daily commuters, who will arrive in part via a new rail line.

"The biggest issue of all is to make sure that the city is balanced and will create as much energy as it uses throughout the time it is being built," says Gerard Evanden, senior partner in charge of the project at Foster + Partners. "The scale of the project will have the density of Venice, so it will grow gradually. Hopefully the knowledge and the technology of efficient materials will grow too."

Some of that future knowledge will be homegrown. Masdar's university is set to open by 2009, with 30 percent of the student population housed on site. Its students will be encouraged to participate in the development of the city while working on graduate degrees in sustainability. *Dianna Dilworth*

(continued from previous page)

safety. But Ghaemi notes that there is no time frame for this draft to become law. A March follow-up report by HRW called the draft a "violation of international standards" and cited "major omissions," including the prohibition of labor organizing and strikes, ambiguity about the minimum employment age, the absence of provisions to ban passport confiscation, and inadequate enforcement or penalties for violations of the law.

Ghaemi contends that although architecture firms in the U.A.E. rarely control worker conditions, they should consider themselves complicit in abuses. "The people designing these facilities should know brick by brick how they are being built," he says. "Labor is an inseparable part of getting all of these structures up."

Several architects working in the U.A.E.—including SOM, Perkins + Will, and FXFowle—were contacted for their opinions but most declined comment. Among those that would talk was HOK. "We're a small component in the equation, and I don't have control over how other people operate," says Daniel Hajjar, regional manager for its Gulf operations. "But I do know how we operate: We operate [in Dubai] as we would if we were in the United States. We don't engage in any activities that would put us at risk with the Department of Labor." He adds that the same goes for firms with whom HOK works on jobs. "The contractors here have really raised the bar in terms of how they work."

HRW hopes that these trickle-down improvements will spread to other parts of the world where abuses are common, such as China and Malaysia. But absent a concerted push for reforms, or pressure on construction companies, observers fear that governments will continue to look the other way. *Sam Lubell*

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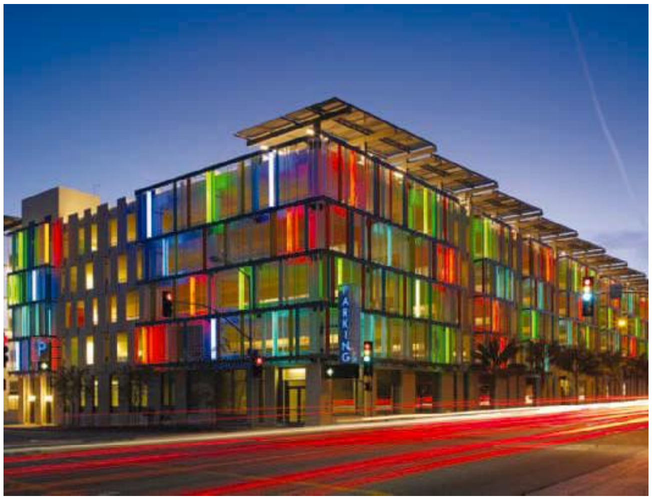
Parking garages driven to good design



The depressing amount of time most Americans spend sitting in traffic has an architectural counterpart in the bleak urban stretches devoted to faceless garages and parking lots. But as cities get serious about curbing pollution and congestion, and rising land prices drive developers to make the most out of tight sites, parking is also getting some architectural attention.

At the recently opened Museum Residences [RECORD, May 2007, page 222], across from the new Hamilton wing of the Denver Art Museum, Studio Daniel Libeskind and Davis Partnership wrapped a 980-space parking garage with the complex's 55 condominium units. The top of the garage, which provides parking for the museum as well, contains a 4-acre landscaped garden for the complex's residents. "Other architects might say, 'We'll put the garage underground and we'll valet park,' " Libeskind explains. "But that's very expensive, so I said, 'Let's do a normal garage, but create an urban setting.' We put recreation on top and used the garage as a hinge of new development. The car is subsumed by the pleasures of living or walking or using the space. We're using the parking to reduce focus on the car."

The Santa Monica Civic Center parking garage features channel-glass bays mounted in precast concrete.

Even car-centric Southern California is embracing similar ideas. Moore Ruble Yudell treated its brief for the Santa Monica Civic Center garage as a challenge. "Parking structures make up our cities," says James Mary O'Connor, AIA, a firm principal, "So we wondered: How can they be about more than parking?" The designers responded with a 900-space facility that features ocean views and a plaza-level café. With photovoltaic panels on the roof and room for bicycles among the automobile bays, it is the first parking structure to earn LEED certification.

The building's six-story facade uses multicolored channel-glass bays mounted in white precast-concrete shells to suggest a rushing crowd. With such detail, O'Connor suggests, parking facilities can become landmarks that attract real crowds. Since it opened in March, the garage appears to be doing just that. "I went by at night and saw tourists taking pictures of each other in front of the facade," O'Connor says. "I thought, 'Well, we've done what we've set out to do.' " *Alec Appelbaum*

Gas stations go green, from fuel to finishes

As gasoline prices speed toward the $4-per-gallon mark, consumers are buying hybrid and flex-fuel cars or filling up with biodiesel, and new ethanol plants are sprouting up to squeeze an alternative fuel from corn. Fittingly, the retailers of these cleaner fuels are using green design to make an architectural statement that their pit stops are as ecoconscious as their fuels.

The roofs of both SeQuential Biofuels (left) and Helios House (above) feature plantings as well as photovoltaic cells.

In Eugene, Oregon, SeQuential Biofuels opened the state's first commercial biofuel facility last year. The station dispenses ethanol as well as locally sourced biodiesel. Company cofounder Ian Hill worked with his mother, Susan Hill, AIA, an architect based in Lexington, Kentucky, to incorporate green features into the station's design. A roof embedded with a 32.6-kilowatt photovoltaic array shelters the pump islands; its central panels have clear backings to transmit more daylight. The roof above an accompanying 2,000-square-foot convenience store also received a green treatment: It is planted 5 inches deep with 4,800 native Oregonian plants. Bioswales adjacent to the parking areas filter storm water.

Alan Eliot Goldberg, FAIA, a former design consultant to ExxonMobil, has developed a prototype station that embraces sustainable materials as well as solar power, which is used to create hydrogen fuel via electrolysis. Adapted from his Advanced Refueling Retail Center concept, it dispenses six different kinds of fuel. The 5,000-square-foot station will include a convenience store and an information center for hydrogen power. "If you're introducing a new product, you should have a new concept," Goldberg says of its design. Developed by the ARRC/H2 Alliance, the first station is planned for Syracuse, New York.

Will the green principles adopted by this small group infiltrate America's massive network of gas stations? BP may have the answer with its Helios House demonstration project, designed by Office dA with Johnston Marklee. Located on a 10,530-square-foot site in Los Angeles, it produces energy via photovoltaics, captures rainwater for irrigation, and reduces the urban heat island effect with a drought-tolerant green roof. Ironically, although these green features make the station eligible for a LEED Gold rating, Helios still dispenses old-fashioned gasoline. At least it's a start. *David Sokol*

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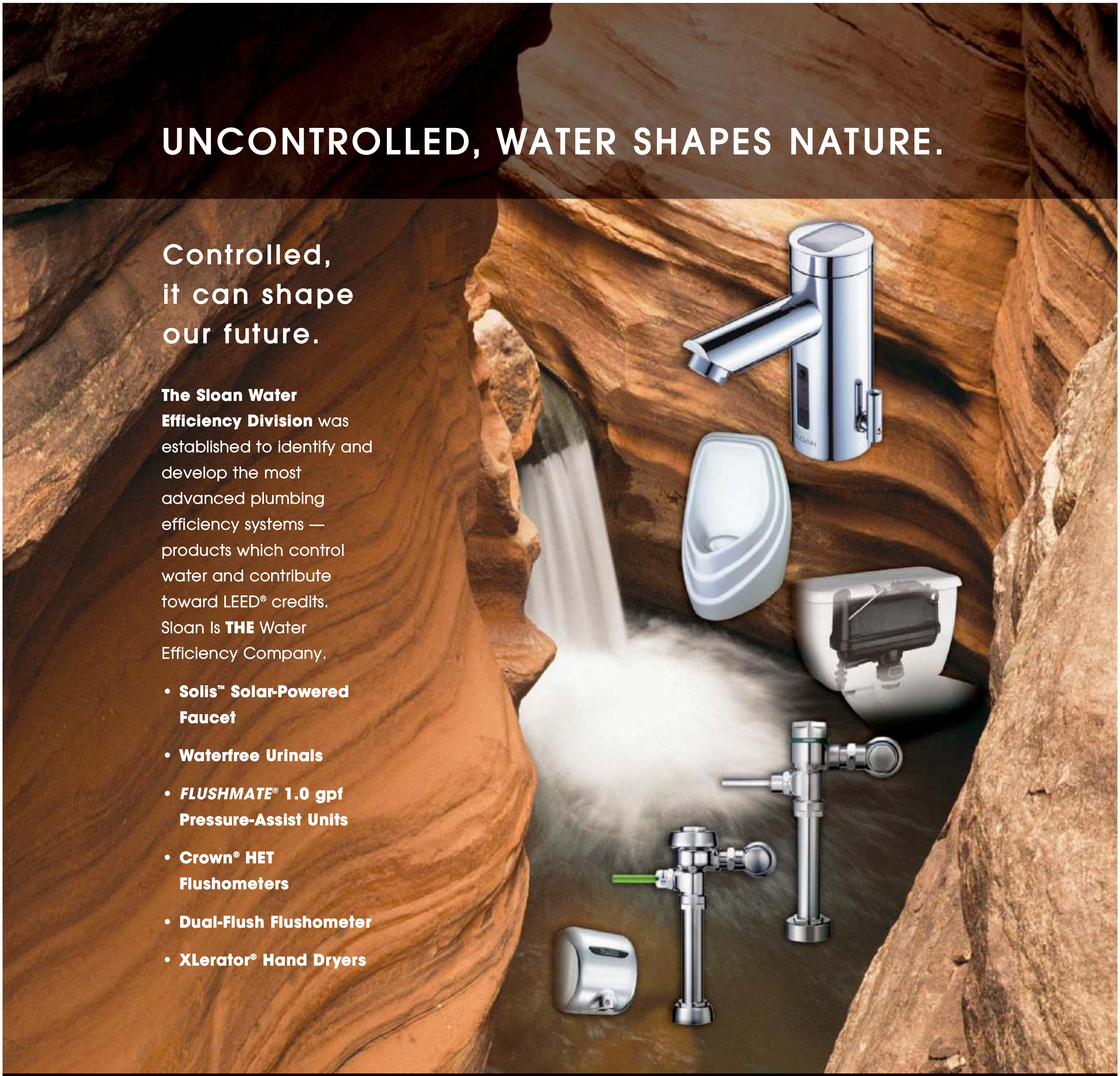

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Action Jackson: Mississippi downtown booms

The rejuvenation of downtown Jackson, Mississippi, was already under way before 2005, but it kicked into high gear following Hurricane Katrina. The Gulf Opportunity Zone Act boosted a preservation tax credit to 26 percent, up from 20 percent. Although this incentive expires next year, it has spurred the repair of older buildings—and new developments are under way, too. "Over the last six years, local developers took a special interest in downtown," says John Lawrence, president of Downtown Jackson Partners, a nonprofit managing the renewal. "But now national investors are looking at us, and that's exciting."

Much of the development is concentrated at the central business district's southeastern edge. More than $450 million of construction is anticipated or currently in progress, including hotel, office, and residential buildings. One project that adds a bit of everything is the King Edward Hotel, a 1923 palazzo-style edifice that is being reconfigured into a Hilton hotel, 60 apartments, and offices. Asbestos remediation in the 300,000-square-foot building, which has stood vacant since the 1960s, finished this spring, and the $75 million construction project will conclude in mid-2009. New Orleans-based Historic Restoration is handling the design.

A few blocks away, an all-new project is transforming several parking lots into the Telecom Center, a convention-center complex designed by Miami-based Arquitectonica in partnership with locally based Dale and Associates. The first section, an 85,400-square-foot theater-and-meeting-room facility with an anodized aluminum skin, opened last year. Its cavernous second story, whose frame resembles a flattened accordion pleat, cantilevers over a pedestal. An atrium features a 50-foot-tall window along its 100-yard length, providing clear views of Jackson's skyline, making the space a popular venue for weddings. The balance of the convention center, encompassing another 259,000 square feet, is set for completion in January 2009. "We knew a project of this magnitude could really energize downtown Jackson," says Bernardo Fort-Brescia, an Arquitectonica principal.

Other projects aim to do the same thing. The New York City–based H3 Hardy Collaboration designed a new federal courthouse that will be located nearby. Three large window walls will jut like TV screens from an articulated precast-concrete facade, allowing natural light into nine of 12 courtrooms, all of which will sport an unusual oval shape. Construction on the $115 million, 395,000-square-foot building will be completed in 2010.

Opening in June was the new Mississippi Museum of Art. Dale and Associates' design raised the roof of an existing masonry structure, creating window-lined eaves, and added a mahogany canopy that stretches to a fountain-lined plaza. The glass-fronted museum, with 54,000 square feet across its single level, plays off the large window of the Telecom Center across the street. Glavé & Holmes Associates, of Richmond, joined Dale on the project.

Dale is also consulting on Capital City Center, a $209 million mixed-use project that calls for 1.9 million square feet of hotels, 350 apartments, offices, and shops. It will occupy a prominent four-block site across from the convention center; an architect has yet to be chosen. *C.J. Hughes*

Margaret Helfand, FAIA, dies at 59

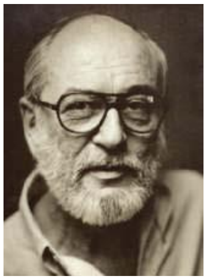
Margaret Helfand, FAIA, died on June 20 at the age of 59 of colon cancer. Since opening her office in 1981, Helfand had created a body of work distinguished for its clean, Modernist vocabulary and skillful use of natural materials, combined with a quiet and subtle inventiveness.

Female architects often find themselves relegated to designing houses and interiors for their entire careers, but Helfand was able to start small and go on to execute the large-scale institutional and commercial work that is more frequently the preserve of her male counterparts. Her best-known projects include the Unified Science Center, at Swarthmore College, designed with Einhorn Yaffee Prescott [RECORD, December 2004, page 198], and the offices of Automated Trading Desk, in Mount Pleasant, South Carolina, with McKellar & Associates [RECORD, June 2003, page 156].

Born in Pasadena, California, Helfand completed her undergraduate education at the University of California, Berkeley in 1969—where she also earned her M.Arch., in 1973. Two years later, Helfand came to New York City, where she joined Marcel Breuer Associates. She remained there until opening her own office. Among numerous awards recognizing her accomplishments, she won a Rome Prize to work in residence at the American Academy in Rome from 2002–03, and she was named a Fellow of the AIA in 1998.

Helfand is survived by her husband of 28 years, Jon Turner, and a sister, Judy Helfand. A celebration of her life will be held Tuesday, October 9, in New York City at 6 P.M. at the 15th Street Meetinghouse of the Friends Seminary. It will be followed by a reception at the National Arts Club, 15 Gramercy Park South. *Suzanne Stephens*

William LeMessurier, 1926–2007



Charismatic, daring, artistic. We don't always associate these qualities with structural engineers, but the highly esteemed William LeMessurier, who passed away June 14 at the age of 81, embodied all of them. Trained as an architect at the Harvard Graduate School of Design, he graduated from the Massachusetts Institute of Technology with a master's degree in building engineering and construction in 1953.

Since starting his practice in 1961, LeMessurier distinguished himself with his sensitivity to architects' aspirations. "He was a real collaborator—he understood what an architect was trying to do and was better able to respond to architects' needs than the normal structural engineer," says Mysore Ravindra, president and principal structural engineer of LeMessurier Consultants. He points to LeMessurier's work on the Federal Reserve Bank of Boston and New York's iconic Citicorp building, both designed by architect Hugh Stubbins, as prime examples of the engineer's understanding of architecture.

In addition to working at his consultancy, LeMessurier taught at both of his alma maters. He retired in 2003, when an advancing case of Alzheimer's obliged him to step down. His wife, Dorothy, says that a memorial service is tentatively scheduled for October 13 at the Harvard GSD. *David Sokol*

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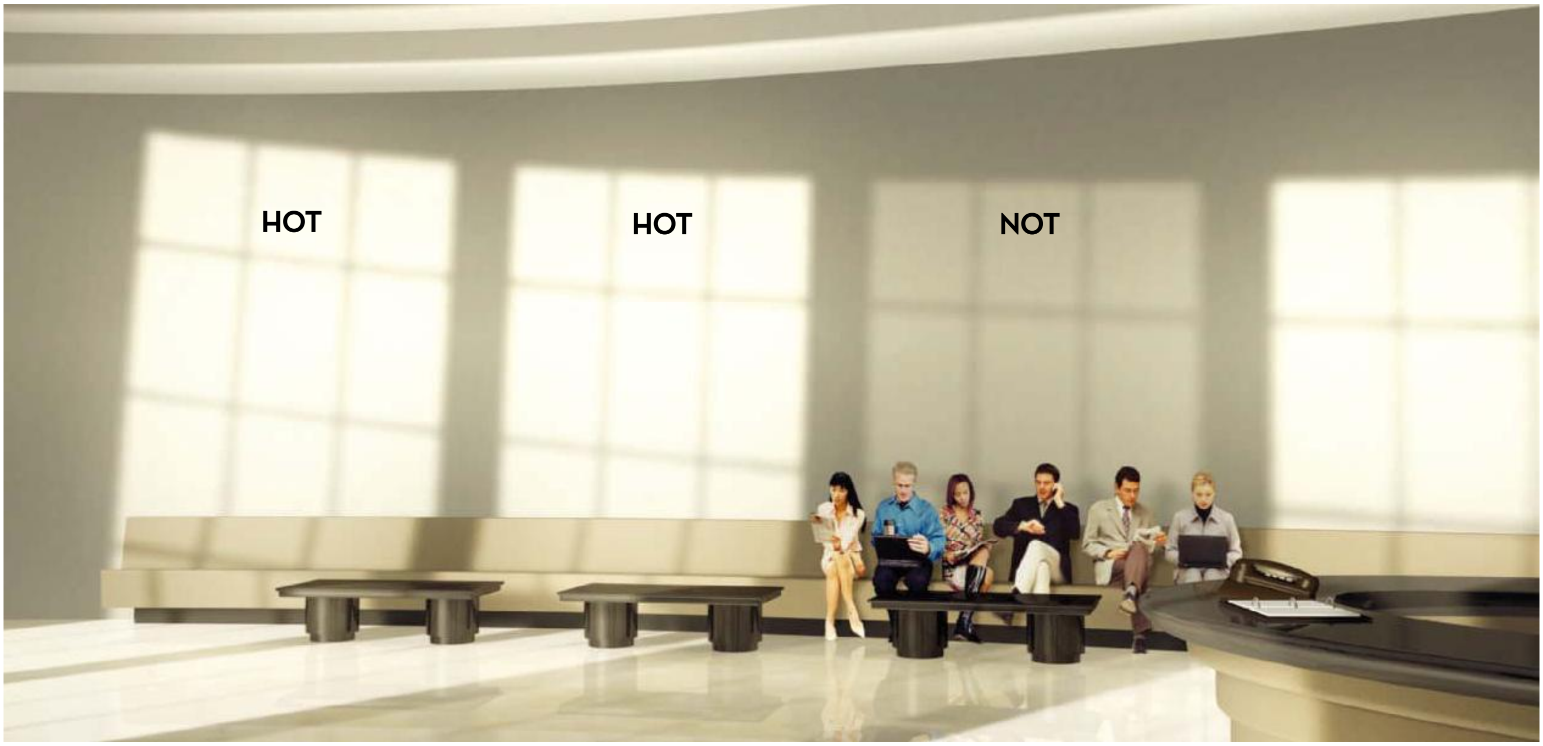

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Mexican museum will foster tolerance

Boxcar (right), used by the Nazis to transport people to death camps in Poland, is installed at Mexico's new Museum of Memory and Tolerance (left).

By itself, the image is not necessarily striking: a battered boxcar being hoisted into place at a construction site. Its power lies in knowing its history. The car, an exhibit at the new Museum of Memory and Tolerance, which opens next year in Mexico City, once transported Jews and other people destined for Nazi death camps in Poland during the Holocaust.

Although institutions commemorating Jewish history are common throughout Europe and the United States, museums that explore tolerance are less so—perhaps because they require something tangible, like the boxcar, to make this abstract concept real. According to Arturo Arditti, a principal of Arditti+RDT Arquitectos, just this sort of museum is needed in Mexico. "There's a lack of knowledge about genocides elsewhere in the world," he explains. "This museum will educate people about history, but it will also show them the importance of diversity, which is not widely addressed in Mexico."

The 70,000-square-foot museum is, significantly, located in Plaza Juarez adjacent to the Mexican Ministry of Foreign Affairs and a federal courts complex, which was designed by Legorreta + Legorreta. Arditti, together with his father and brother—who make up the family-owned Arditti+RDT—took aesthetic cues from these government buildings. Wood-framed windows, inset into the exposed concrete walls of the podium, continue a rhythm established on the ministry's facades. A four-story cube rises from this base. Along its south elevation, facing a plaza defined by the Legorreta buildings, a glass wall allows light into a central atrium.

A children's memorial, intended for children, will be located inside a small cubic volume cantilevered above this internal void from two supports—"like two hands holding it," Arditti says. While the Polish boxcar is unquestionably the museum's most important historic artifact, Arditti sees this children's space as its main architectural and symbolic element. "The only way to change prejudice is to educate kids," he says, "because older people won't be able to change." *James Murdock*

Saitowitz/Natoma's Tampa museum approved

Four times could be the charm for the Tampa Museum of Art, in Tampa, Florida. The museum's building committee voted unanimously in May to forge ahead with Stanley Saitowitz/Natoma Architects' design for a new facility to be located on the site of its existing home, which will be demolished. The committee chose the San Francisco–based architect last November. Trustees had nixed a design by Rafael Viñoly in 2004, citing concerns over that project's estimated cost, as well as two other schemes.

Saitowitz/Natoma's 68,000-square-foot building, the first phase of a possible larger structure, takes the form of side-by-side cubes—a two-story box with tall ceilings containing galleries, and a three-story box for support spaces—connected by a steel bridge and cantilevered over a glass-enclosed podium. The cantilever helps elevate most of the museum above the city's flood plain and provides shading for a park and sculpture garden. The cubes' curtain wall will be composed of two layers of perforated metal that allow daylight in and views out. Saitowitz describes this surface as "rippled and shimmering" like the Tampa waterfront.

LED lights, sandwiched between the metal facade layers, will project changing colors at night. Artists can control this lighting for site-specific installations. The museum's interior will feature a large lobby with a 40-foot-by-40-foot skylit atrium. Galleries wrap around it, enclosed by the same perforated metal as the facades. A landscaped green roof will provide sustainability benefits and space to host functions.

Construction on the new building is expected to begin early next year and be completed by 2009. The museum is raising $25 million toward capital costs and its endowment, while the city has pledged $17.5 million in Community Investment Tax bonds. *S.L.*

Piano designing Kimbell expansion

The anointing of Renzo Piano to design an addition to the Kimbell Art Museum, in Fort Worth, seems almost preordained. He worked for Louis I. Kahn during the 1960s and has three critically acclaimed art museums in Texas: the Nasher, the Menil Collection, and Cy Twombly Gallery.

Piano called the Kimbell commission, announced in April, "an awesome challenge, but an attractive one." His addition will be located diagonally across the street from Kahn's 1972 original on land the museum bought in 1998. It will provide space for temporary exhibitions, allowing the Kimbell to display more of its small but exquisite permanent collection. "No other museum puts paintings of this quality in storage," former director Timothy Potts said at the time. "Yet we often do it for half a year."

This matter-of-fact announcement contrasted sharply with the fireworks surrounding a 1989 proposal by his predecessor, Ted Pillsbury, to add several vaulted galleries to the original building. Critics, architects, and especially the Kahn family denounced that plan as a sacrilege. The expansion idea resurfaced in early 2006 at a dinner attended by Potts, trustees Ben and Kay Fortson, and Kahn's daughter Sue Ann. It wouldn't be a physical extension this time, but a separate building with its own program and architectural identity. The "hands-off" approach delighted Sue Ann Kahn, the most ardent defender of her father's architectural legacy.

Piano has toured the site and studied its relationship to a nearby building by Tadao Ando, but details about the size, cost, and timing of the expansion are yet to be determined. What is clear is that this time around, nobody is likely to complain about "adding brush strokes to a Picasso."

"I doubt we could do better than Renzo," says Sue Ann Kahn. "He knows Texas. He's been to see the Ando building. He'll ponder the relationship of old and new. You can't beat those odds." *David Dillon*

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Razing Arizona: Phoenix Modern threatened

Developers are eyeing a park (left) adjacent to the former Valley National bank (far left).

If the fate of its midcentury bank buildings is any indication, Phoenix is withdrawing valuable architectural assets from its skyline to make way for growth in what is the nation's fifth-largest city. Already lost are two celebrated neighborhood bank branches razed earlier this year: the Ed Varney–designed First Federal Savings branch, and the geodesic-dome Valley National Bank, in nearby Tempe, designed by Weaver & Drover, now called DWL. Dating to the early 1960s, they expressed Phoenix's postwar commitment to regional architecture.

The Valley National was the brainchild of longtime bank president Walter Bimson, an arts patron and friend of Frank Lloyd Wright, who dismissed drive-up windows and preferred that customers meet with tellers face-to-face. Preservationists now worry that another former Valley National, currently a Chase Bank, could be threatened. Located in the Arcadia neighborhood, this 1967-vintage building is often mistaken for a work by Wright. Its precast-concrete mushroom columns, view windows, and the careful interweaving of modern materials with hand-selected local rocks are in fact Wright-inspired touches by Weaver & Drover project architect Frank M. Henry, who still teaches at Taliesin West.

The 4.7-acre Chase site includes the 9,000-square-foot bank, a parking lot, and a greenbelt park that is the last to buffer commercial and residential uses in Arcadia. But developer Opus West has proposed replacing the park and some of the parking lot with a complex containing condominiums, restaurants, and retail space. "Our plans call for a design that is appropriate in today's development market and preserves the bank branch," says Jeff Roberts, the firm's vice president of real estate development.

Critics respond that even if the bank itself is spared, its original intent would be destroyed. "The new building would intrude on the historic context and site of the bank, which was created and designed to be a combination of architecture, public art, and open space," says Arcadia resident Roger Brevoort.

Opus West's project awaits a hearing this summer before the Phoenix Planning Commission—a meeting at which the developer can bank on hearing from Brevoort and others. *David M. Brown*

Bush library architect selection begins

It's getting to be legacy time for President George W. Bush, and that means building a presidential library—which, after months of official denials and equivocations, is headed for Southern Methodist University (SMU), in Dallas, the alma mater of first lady Laura Bush. This location was confirmed in an RFQ issued on May 24 by 3D/I, a Houston-based firm hired by the Presidential Library Foundation to oversee the selection process.

The RFQ outlines a 145,000-square-foot library and 40,000-square-foot public-policy institute on "property that SMU recently acquired." The project must be compatible with "the distinct architectural character of SMU," that is, Georgian, and "commemorate and celebrate the accomplishments of President Bush." Kevin Sloan and Alan Chimacoff, then both of Hillier Architecture, assembled the master plan. A dozen architects received the RFQ. They include Cesar Pelli Associates, Robert A.M. Stern, HOK, and Hammond Beeby Rupert Ainge, as well as Texas-based Lake/Flato, Overland Partners, HKS, and Beck Architecture. These firms had until July 25 to provide management plans; a winner could be announced this month.

The RFQ confirmed what observers suspected since SMU beat out Baylor, Texas Tech, and the University of Dallas in a high stakes competition last fall. But SMU's coup was overshadowed by lawsuits initiated by property owners who contended that the university duped them into selling on the cheap, as well as by harsh criticism from SMU professors who fear that Bush's public policy institute will be a partisan think tank. Although SMU prevailed in these suits, it's unclear how much influence professors will have over the independently staffed policy institute. Also unclear is an exact location on campus where the library will be constructed, and a price tag for the project, although this is believed to be roughly $200 million. *D.D.*

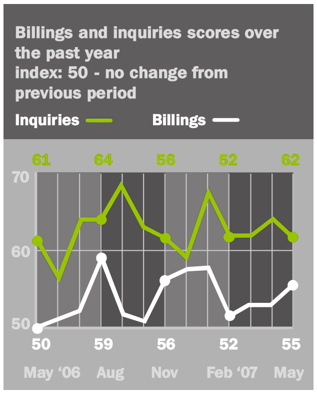
Taliesin regains HLC accreditation

The Frank Lloyd Wright School of Architecture regained full accreditation from the Higher Learning Commission (HLC) in June. Its future had been in doubt since the HLC placed it on notice in 2005, following falling enrollment and turmoil within the Frank Lloyd Wright Foundation, which runs the school. Maintaining HLC accreditation is a prerequisite for National Architectural Accrediting Board accreditation, which the school currently has for its master's program.

"The stakes were very high for accreditation," observes Victor Sidy, AIA, who was appointed as the new dean two years ago.

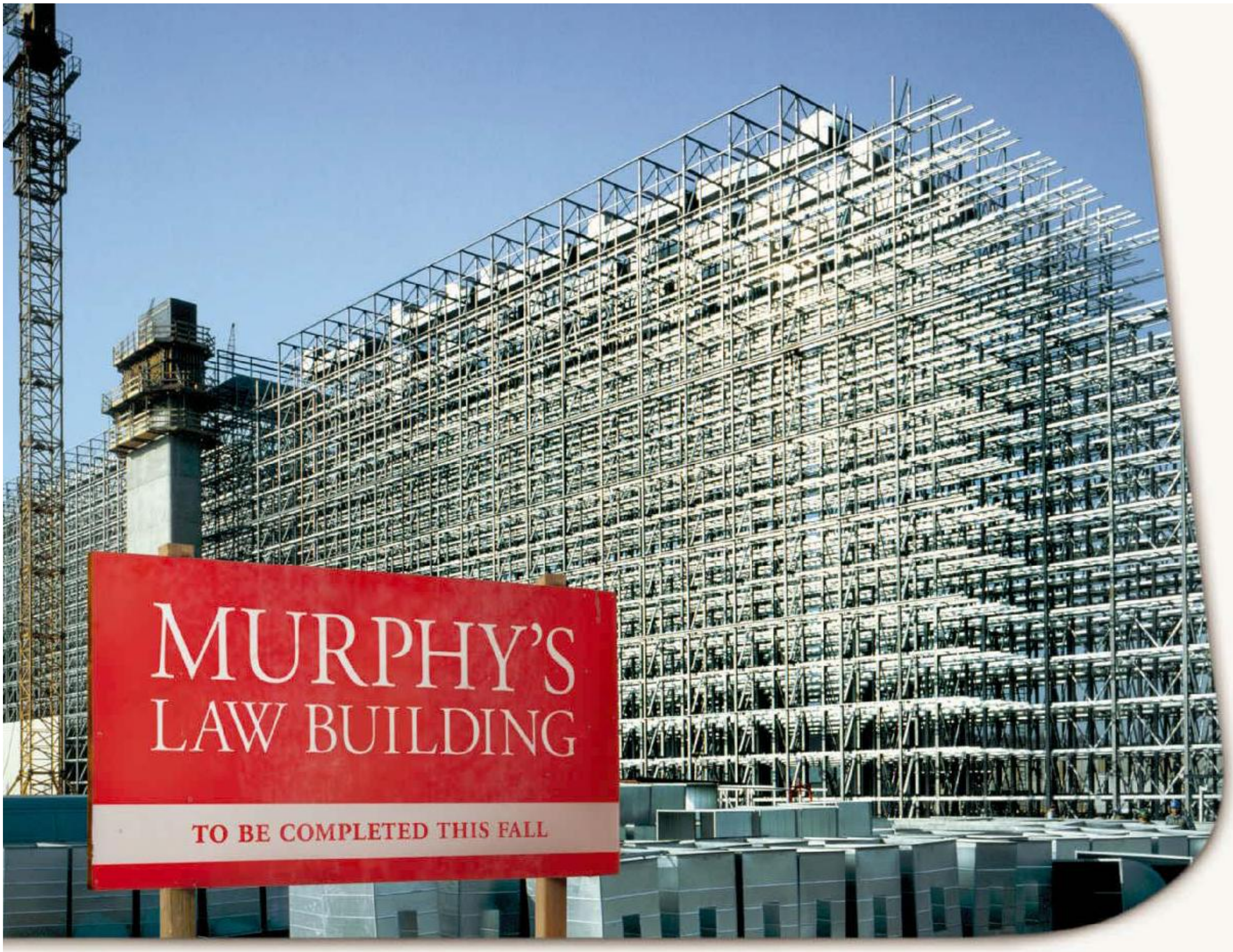
HLC reaccreditation marks a bright spot for the otherwise beleaguered Wright foundation, which has suffered financial woes and board turmoil during recent years. In response, the group revamped its organizational structure. Among the changes: The Taliesin Fellowship, a group of longtime Wright disciples, forfeited veto rights on the foundation board. *Tony Illia*

AIA's billings index posts healthy gain



The American Institute of Architects' Architectural Billings Index gained 2.3 points in May, for a total score of 55, after holding steady during the previous two months. Any score above 50 reflects growth. The number of new business inquiries, meanwhile, declined slightly to 62.4 points. These indices are prepared based on surveys sent to 300 mostly commercial design firms. Studies suggest they are a good predictor of construction levels nine to 12 months in the future. *J.M.*

PHOTOGRAPHY: COURTESY ROGER BREVOORT (TOP RIGHT); DWL (TOP LEFT); SOUTHERN METHODIST UNIVERSITY (MIDDLE)



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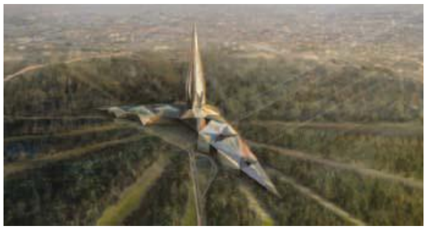
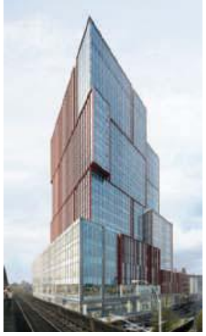
RMJM Group bought Hillier Architecture for $30 million on June 18. For Princeton, New Jersey–based Hillier, which has 350 employees in five offices nationwide and in China, the deal represented the end of a two-year process initiated by former chairman J. Robert Hillier. "We have been exploring various ways to transition the firm as I got closer to being more senior than I wanted to be," explains Hillier, who founded his firm in 1966. Peter Morrison, RMJM's C.E.O., adds that acquiring Hillier gives the Edinburgh-based firm an established presence in the U.S.—the last major market that this 750-person global giant had yet to enter. The combined firm now has more than $15 billion in projects under design. (Hear a podcast with Hillier and Morrison at architecturalrecord.com.) *J.M.*

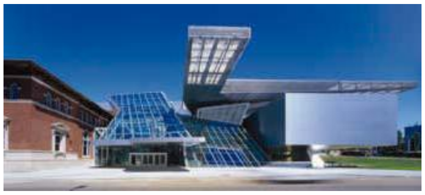


Foster + Partners has designed Yugra, a 919-foot-tall skyscraper for developer STT Group in the Siberian oil boomtown of Khanty Mansiysk. The 56-story, crystalline tower will be among Russia's tallest. Situated in a wooded hillside at the edge of town and flanked by two diamond-shaped buildings, Yugra will contain shops, offices, two hotels, and residences. Construction on the 1.7-million-square-foot complex is set to begin next year and finish by 2012. *Paul Abelsky*

The National Council of Architectural Registration Boards (NCARB) convened in June for its 88th annual meeting, at which it established an official position on sequencing for the Intern Development Program (IDP) and Architect Registration Examination (ARE). Previously, NCARB had recommended that candidates earn a National Architectural Accrediting Board–accredited degree, complete IDP, and then pass the ARE. Its new position removes the requirement that candidates must finish IDP before being eligible to complete the ARE, and it formally acknowledges a jurisdiction's right to allow candidates to complete the ARE and IDP concurrently. Nine of NCARB's 54 jurisdictions had already allowed concurrent sequencing. Also at the meeting, Douglas K. Engebretson, FAIA, of Tessier Associates, was elected NCARB's new president. *Kelly Davidson*



Harlem will get its first major office building in three decades: a striking glass tower designed by Swanke Hayden Connell Architects for Vornado Realty Trust. Named Harlem Park, the 340-foot-tall, 21-story structure will be the neighborhood's tallest. It replaces a parking lot located at Park Avenue and 125th Street, a gritty corner yet to be affected by the area's booming residential and retail development. "We embraced the squat and masculine forms of the Harlem neighborhood," says Roger Klein, a design principal, of the building's irregular composition of stacked boxes. Construction is expected to begin this month and finish in 2009. *Jenna M. McKnight*



Coop Himmelb(l)au's first project in the Americas, the Akron Art Museum's John S. and James L. Knight Building, opened on July 17. The 63,000-square-foot wing adds to an 1899 Renaissance Revival structure. The addition's aluminum-skinned "Gallery Box" floats in a 51-foot cantilever, while a 57-foot-high "Crystal"—a volume that connects it to the older structure—flings glass shards at arrhythmic angles to enclose a new entry and atrium. Topping it is the "Sky Cloud," a 327-foot-long cross whose wings cantilever to distances of 70 feet. *Charles Rosenblum*

ENDNOTES

- Arcadis, a Dutch environmental and infrastructure engineering firm, acquired Baltimore-based RTKL Associates for an undisclosed amount in July.
- Oldcastle Glass purchased Vistawall Group, making it the largest manufacturer of architectural glass and aluminum glazing systems in North America.
- The Royal Institute of British Architects awarded Grimshaw Architects' Southern Cross Station in Melbourne its prestigious Lubetkin Prize.
- Mitchell E. Sawasy, AIA, of Rothenberg Sawasy Architects in Los Angeles, was voted president-elect of the International Interior Design Association.

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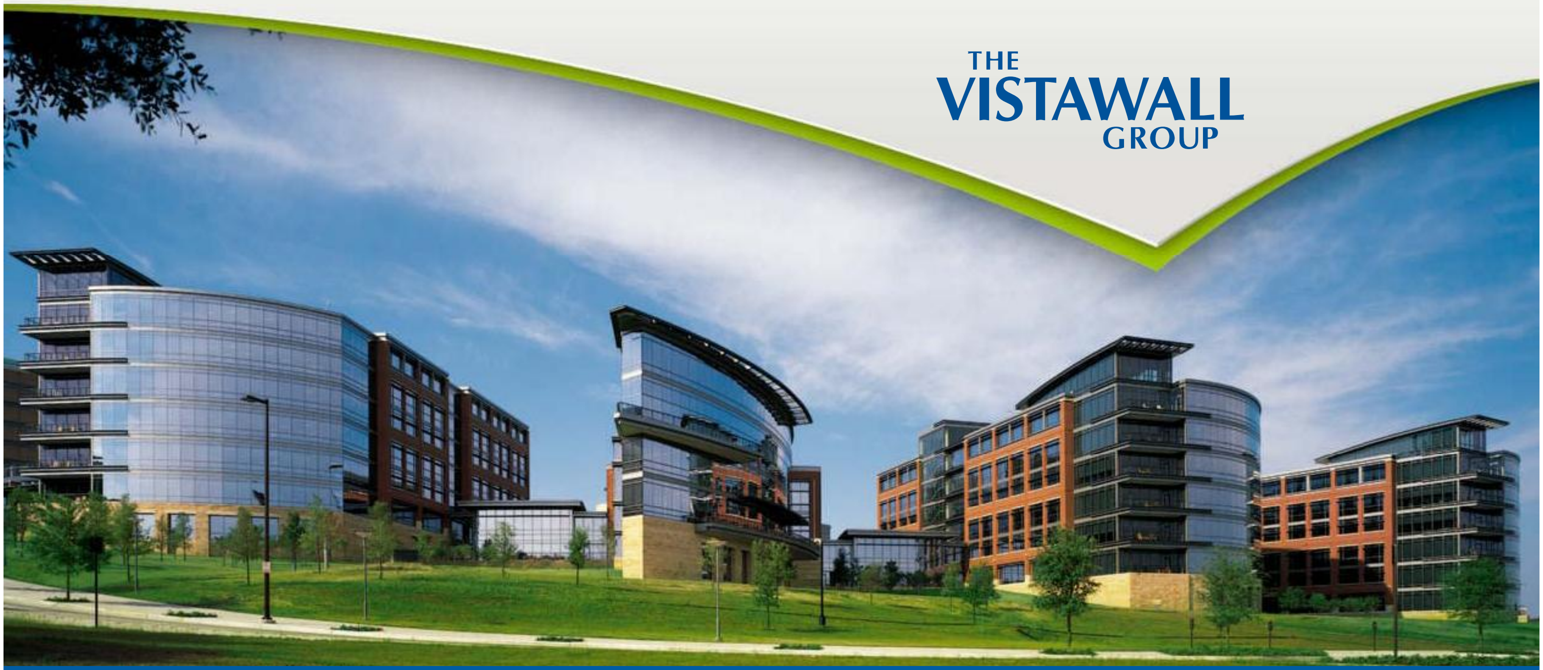

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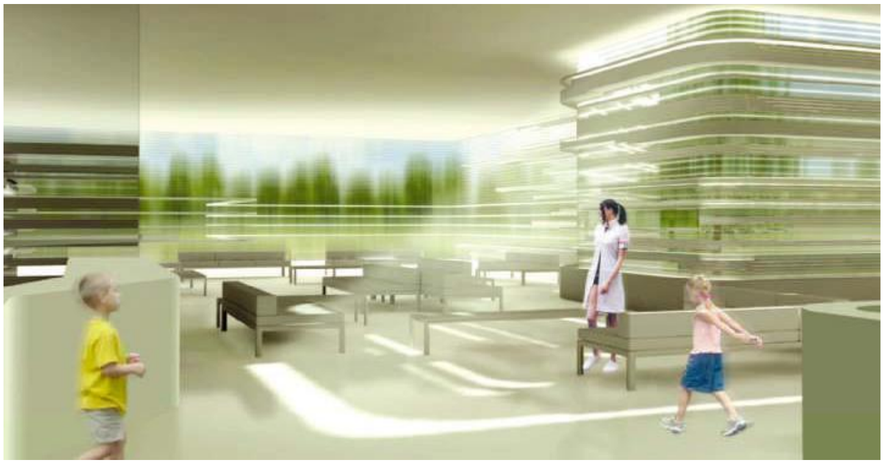
Design

Studio ST: From inside to the ground up

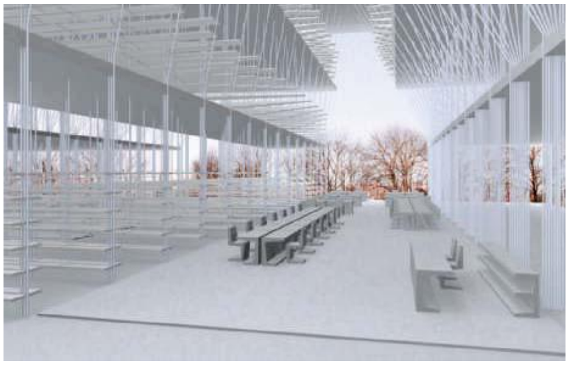
When Israeli architect Esther Sperber left Pei Partnership Architects to strike out on her own with Studio ST in 2003, she was excited, nervous, and up to the challenge. "Having the opportunity to work so closely with Mr. Pei was amazing," she says. "It felt like we were dealing with the end of High Modernism. I knew it was a gamble to start my own firm, but I was interested in trying something new, and putting into practice some of the technologies I had learned in school." That was Columbia's Graduate School of Architecture, which Sperber attended after moving to New York from Jerusalem in 1997. "There was a huge emphasis on doing those crazy computer-generated blobs when I was there," she says. "The blobs weren't that interesting to me, but the technology was. I'm very interested in expanding the palette of forms, construction methods, and ways of making spaces, as a means of allowing a better focus to try to create places and spaces for human activity and interaction."

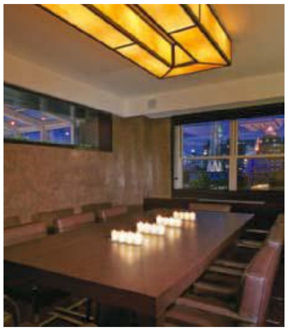
Sperber spent her first year on her own sharing an office with another young firm, dZO, and the two practices collaborated on a number of international competition submissions. "Competitions are refreshing and fun," she says. "Though there's a side to them that's a little exploitative, they're an opportunity to think through design challenges." After that first year, word of mouth got Sperber interior renovation jobs, and she has been able to put her philosophies and expertise into action ever since, as her two-person firm now has a roster of high-end residential renovations completed or under way, as well as new construction projects for real estate developers. While she enjoys the high-end residential projects' big budgets,



Mediatheque, Carnoux-en-Provence, France, unbuilt
A modern library (above) where a bookshelf/wall of stacked glass-and-concrete blocks links inside and out.

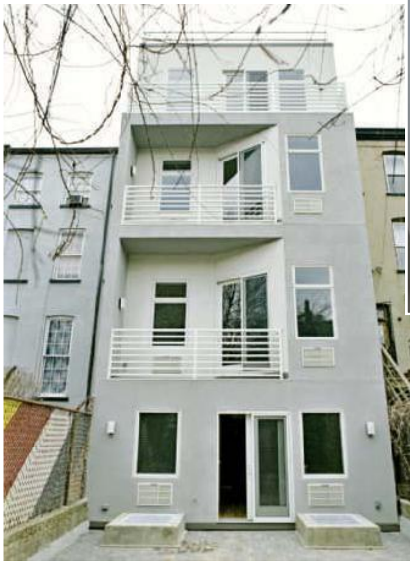
National Library of the Czech Republic, Prague, unbuilt
This library (below) calls for reading halls, a theater, lecture halls, offices, work spaces, labs, and book-storage areas that celebrate interaction with the public.





Village Duplex, N.Y.C., 2006
A 2,200-square-foot duplex (above) with a series of differentiated spaces including a glass-and-metal conservatory and large dining room.

IMAGES: COURTESY STUDIO ST (THIS PAGE AND OPPOSITE, TOP TWO)



State Street Town House, Brooklyn, N.Y., 2005
A gut renovation, this town house was divided into four apartments, adding 320 square feet to each floor.

she's excited about her latest ground-up projects, including a private house in New Jersey. "It's a small budget, but with clients who are very open to new ideas. And working with a tighter budget forces you to focus on simplicity, space and light, and efficient proportions."

Efficiency is a big part of Sperber's design philosophy, which is where her love of new technology comes in. "When anything is cut by a computer-generated machine, you can use smaller pieces and save materials and time," she says, referring to a home project in Atlanta, Georgia, currently in design called the Slice House (view plans at architecturalrecord.com/archrecord2), where she will use precut and prewired structurally insulated panels that are attached to one another and don't require additional stick framing. The home will also have everything in place to easily add photovoltaic panels if and when the client decides to take the next step with sustainability.

For Sperber, the next step personally is taking a few months off to have a baby, which she admits is not easy to schedule when you run your own very small firm. With as many projects as she has in the works, however, she'll be back in the office soon. "There's nothing like the smell of wet concrete," she says, "so I know I won't be away from the joy of making buildings for long." *Ingrid Spencer*

ONLINE: To view additional photos and projects by Studio ST, and to comment on this article, go to **architecturalrecord.com/archrecord2/**.

Work

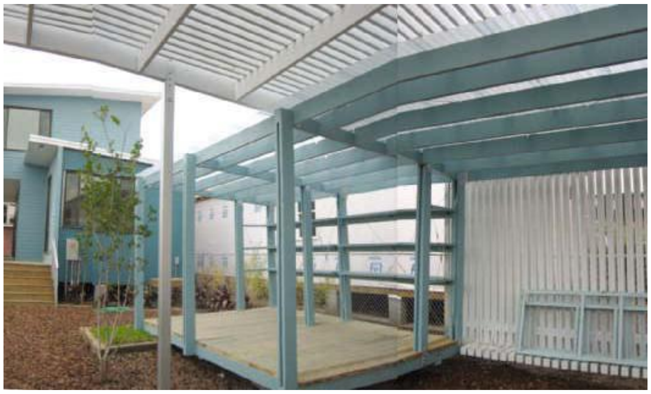
URBANbuild students bring hope to New Orleans

Even before Hurricane Katrina decimated New Orleans, housing in the city was a problem. Tulane University's School of Architecture, under an umbrella program of the school called Tulane City Center, had been working to help since the summer of 2005, with a design-build studio called URBANbuild. "Thirty-three percent of people in Orleans Parrish were living below the poverty line before Katrina," says Byron Mouton, codirector of URBANbuild. "Our program was designed with a 'macro scale,' which concentrates on research at the regional/city/neighborhood scale, and a design-build 'micro scale,' concentrating on research at the neighborhood/dwelling/material scale." According to Mouton, since the hurricane, these and other outreach programs under Tulane City Center's auspices have gained strength, as justification of their necessity has been established and funds have become available.

Thanks to that urgency, the partnership with community nonprofit agencies that specialize in affordable housing and neighborhood redevelopment, and the hard work of faculty and 12 undergraduate students, URBANbuild has completed its second design-build project, Prototype 02—a variation on the typical New Orleans camelback home, and an experiment in new building technologies. Located in a blighted area called Central City, the 1,320-square-foot house was built with panelized steel-stud walls.

"This is the second prototype house we've completed in this studio," says URBANbuild project manager Emilie Taylor. "The first one was a more cautious effort done with traditional stick framing, but because the panelized walls for 02 were made in a warehouse, we could save time during the construction process."

And because the two-semester time frame of the class meant one semester for design and one for building, more time was essential. Except for the licensed trades, the students do all the work. "Starting in January, we were putting in well over 40-hour weeks to stay on our 15-week schedule," says student Matthew Shaver. "We want to disperse the product," says Mouton. "Our goal is to replace homes to repair neighborhoods." While the URBANbuild studio continues to modify its design to reach the best solution for mass production, a separate studio at Tulane led by local architect Coleman Coker, called Greenbuild, and producing a modular home, will also be completed this year. With that house the third in the series, the Tulane City Center program is well on its way to helping provide alternative housing solutions to the city at an affordable cost. Until the program gets the plans for the URBANbuild homes mass-produced, neighborhood housing agencies are finding buyers for the prototypes. The first has been sold for $120,000 (had the buyer qualified for low-income status, he would have been able to purchase the property for less), and the second is currently available for purchase.



The Prototype 02 house (above) was designed and built by students from the URBANbuild design-build studio (left).

With all the success of the program, Mouton admits it's still a struggle. "We're often trying to build in parts of the city that should become greenspace," he says. "But the people from these areas are proud, and they're not about to give up the neighborhoods they've lived in for years. It's a larger urban issue that we're very much involved in." *I.S.*

ONLINE: To view additional information about URBANbuild, and to comment on this article, go to **architecturalrecord.com/archrecord2/**.

PHOTOGRAPHY: COURTESY URBANBUILD (BOTTOM TWO)

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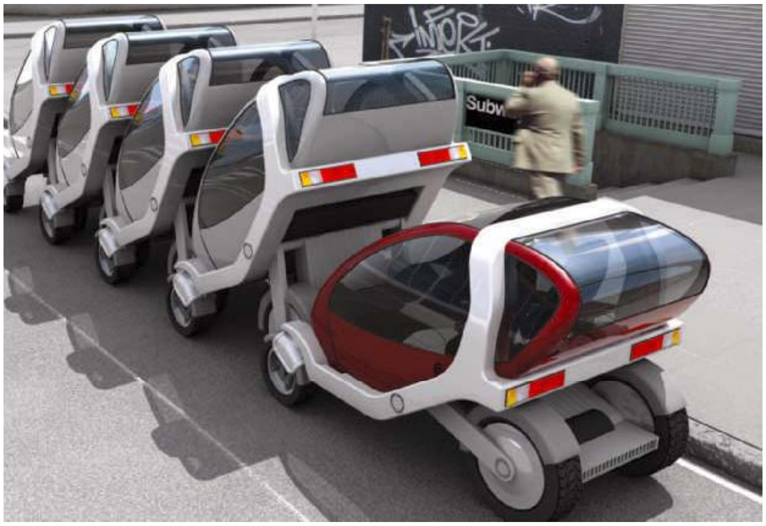
Going the extra mile to make mass transit more personal

Critique

By William J. Mitchell



Six to 8 stacked City Cars can fit into one traditional parking space. When located at major origin and destination spots, such as transit stations, they can carry people the last mile to their final destinations.

IMAGES: © FRANCO VAIRANI/MIT SMART CITIES PROJECT

For too long, too much of the discussion about urban mobility and its relationship to sustainability has been locked into an increasingly sterile debate between proponents of public transit and advocates of the automobile. Both sides ignore some inconvenient truths.

Transit enthusiasts point out the inherent efficiencies of high-capacity public-transportation networks, but often neglect to mention that, under most practical circumstances, they offer no solution to the "last-mile" problem. They can get you to approximately where you want to go approximately when you want to get there, but rarely exactly. You still have to get from the nearest transit stop to your actual destination. It is nice to imagine that this problem could be handled by clustering high-density development within convenient walking distance of transit nodes, and sometimes it can—at least partially. But this is far from a general solution. Often, circumstances conspire against it: The distances are too great; it's impractical for the aged, small children, and the physically impaired; it can expose you to a variety of dangers; it's unattractive in rainy, snowy, very cold, or very hot weather; and it just doesn't work if you have a lot of stuff to carry.

Defenders of the private automobile emphasize that it provides mobility on demand, there are no timetables for its use, and it gets you right to your destination. As a result, people really *like* their cars—not only for the convenience they offer and their elimination of the "last mile," but also because they function as powerful emblems of personal freedom and social status. Furthermore, the economic, social, and cultural vibrancy of cities depends upon dense, convenient, unrestricted interconnectivity, and automobiles have become universal agents of this.

The problem with cars, which has become increasingly evident as their popularity has grown, is that the scale effects and externalities come back to bite you. When there is an extensive road network with few vehicles on it—as, for example, on the Los Angeles freeway system late at night, it's indeed astonishingly quick and easy to get around. But when the network becomes choked with traffic, congestion and delays begin to negate the automobile's advantages. Automobiles account for huge percentages of the energy consumption of cities, producing economic and geopolitical problems in the short term and a significant threat to sustainability in the long term. Tailpipe emissions turn out not only to produce local pollution, but also to contribute to global warming.

In my Smart Cities group at the MIT Media Laboratory, we have been developing a third option—a clean, compact, energy-efficient City Car that promises high levels of personal mobility at low cost, and effectively complements transit systems by, among other things, efficiently solving the "last-mile" problem. This project illustrates the growing potential of ubiquitously embedded intelligence and networking to revolutionize the ways we design and operate buildings and cities.

The crucial enabling technology of the City Car is an omnidirectional robot wheel that we have developed. This wheel contains an electric-drive motor, suspension, steering, and braking. There are no mechanical linkages connecting the robot wheels to the driver's controls. In other words, the car is fully drive-by-wire, with just an electric cable and a data cable going into each wheel, which has a simple, snap-on mechanical connection to the chassis.

Elimination of the traditional engine and drive train enables modularization of the mechanical systems and offers great flexibility in design of the body and interior. We have taken advantage of this to create small, lightweight passenger vehicles that fold and stack like shopping carts at the supermarket or luggage carts at the airport. The independent, omnidirectional wheels provide extraordinary

William J. Mitchell is the head of the MIT Media Lab's Smart Cities research group.

maneuverability: Cars can spin on their own wheelbases instead of making U-turns, and can parallel park by slipping in sideways. Depending on context, six to eight folded and stacked City Cars can fit in one traditional parking space.

Although City Cars can work quite nicely as privately owned vehicles, they provide the greatest sustainability benefits when they are integrated into citywide, intelligently coordinated, shared-use mobility systems. The idea is to locate stacks of City Cars at major origin and destination points, such as transit stops, airports, hotels, apartment buildings, supermarkets, convenience stores, universities, hospitals, and so on. You just swipe a credit card, drive a vehicle away from the front of the stack, and return it to the rear of another stack at your final destination. From the user's perspective, it's like having valet parking everywhere.

From the operator's perspective, it's a mobility service business. Success depends on having enough stacks and vehicles to satisfy demand, while minimizing unnecessary capacity and implementing an effective strategy for tracking vehicles through GPS and redeploying them, as necessary, from points of low present demand to points of high present demand. This system enables a high vehicle-utilization rate, doesn't leave cars sitting uselessly around for most of the time—as private automobiles do—and minimizes the number of vehicles needed to provide a high level of personal mobility within an urban area.

City Cars can serve as intelligent agents, storing and providing energy to the power grid.

This isn't entirely new. The feasibility of shared-use, personal-mobility systems based on vehicle stacks in urban areas has recently been demonstrated by the Velo shared-use bicycle system in Lyon, France. Currently, this system is being extended to Paris with approximately 2,000 stacks and 20,000 bicycles.

Just as your electric toothbrush automatically recharges when you replace it in its holder, so City Cars automatically recharge when they are parked in stacks. Since they only need to travel from stack to stack, they don't need long ranges or the associated bulky, heavy, and expensive battery packs that are, unfortunately, characteristic of today's electric and hybrid cars.

Intelligent agents

When City Cars are stacked, they add storage capacity to the electric grid. They function as intelligent agents with the capacity to buy electricity from the grid when they need it and prices are low, and also to sell electricity back when they don't need it right away and prices are high. In effect, they become active, alert traders in a dynamic electricity market. This helps the power grid to even out peaks, and allows it to make more effective use of renewable but intermittent power sources such as solar and wind. A project developed by Google and Pacific Gas and Electric, using plug-in hybrid cars, has already demonstrated (on a very small scale) the idea of vehicle-to-grid power.

Large-scale implementation of this concept would be a significant step toward transforming cities into distributed, virtual power plants—an Internetlike arrangement that promises many sustainability and security advantages. Buildings would not only consume electricity, but also produce it through various combinations of solar, wind, and hydrogen-fuel-cell technologies. Vehicles, and perhaps some buildings, would provide battery-storage capacity. The system would be coordinated through ubiquitously embedded intelligence and networking. Vehicles, appliances, and the mechanical and electrical systems of buildings would become intelligent economic agents, trading in energy markets with knowledge of demand and price patterns and the capacity to compute optimal buying and selling strategies.

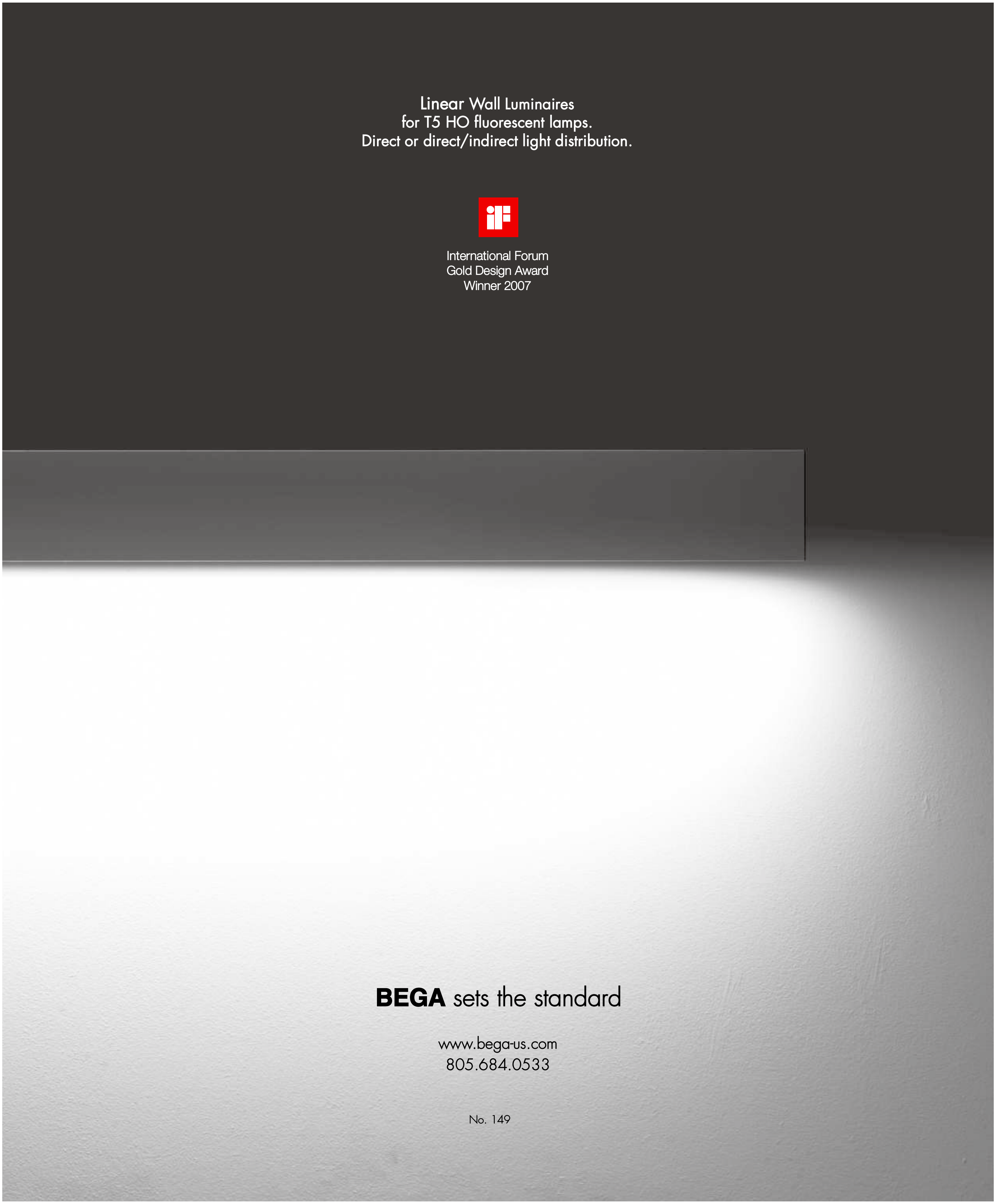
The concept of intelligent agents operating cleverly in markets with dynamically varying prices can be extended, as well, to road space and parking space. Consider, for example, a citywide system that monitors traffic volumes in real time on a block-by-block basis, adjusts congestion road prices accordingly, and conveys this information to the GPS navigation systems of wirelessly networked City Cars. Drivers could then ask their navigation systems to find the quickest paths to destinations subject to cost constraints or the cheapest paths subject to time constraints. This produces a feedback loop controlling the allocation of road space: Vehicles adjust their routes in response to current price patterns, and price patterns adjust in response to vehicle densities.

We propose a similar approach to parking space. Using a simple sensing mechanism combined with wireless networking, City Cars can monitor the availability of parking stalls and stack space near their destinations. Based on instructions from drivers about the urgency of finding parking and the acceptability of some displacement from their destinations, City Cars might automatically bid in eBay-style auctions for available spaces and then guide drivers to them.

With our sponsor, General Motors, we have prototyped and demonstrated the feasibility of the crucial elements of the City Car system, and are currently exploring possibilities for implementing it in realistic contexts. A major exhibition on the City Car will open at the MIT Museum on September 28.

The City Car illustrates a general principle that, I believe, will become increasingly important in architecture and urban design as the technology of ubiquitously embedded intelligence takes hold and as designers recognize and respond imaginatively to its possibilities. Vehicles, appliances (both fixed and mobile), and the various mechanical and electrical systems of buildings will all evolve into specialized, networked robots that can make decisions and respond intelligently to the varying conditions of the larger environments within which they are embedded. Resources—particularly energy and space—will be managed and allocated in far more sophisticated ways than they are today. The effects on patterns of space use, building systems and their functionality, and the prospects for long-term urban sustainability, will be profound—often in ways that are, as yet, unimagined. ■

ONLINE: Would City Cars work in your town? Respond at ***architecturalrecord.com/features/critique/***.



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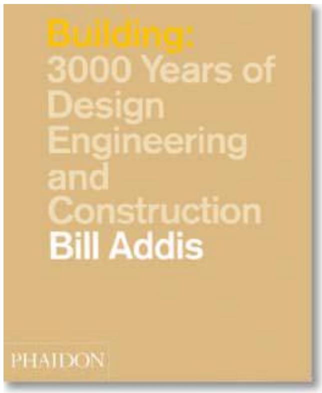
Finding the magic when architects and engineers collaborate

Books

Building: 3000 Years of Design, Engineering, and Construction, *by Bill Addis. New York: Phaidon, 2007, 640 pages, $75.*



This monumental and extraordinarily ambitious look at innovation and creativity in engineering and building construction over 3,000 years represents a tour de force in the literature of engineering. Replete with 800 illustrations, the book is impeccably designed as a reference for both architects and engineers. It is both an erudite tribute to engineers who have advanced building construction from Greco-Roman times to the present and a convincing plea for increased teamwork between architects and engineers throughout the design process.

The author assumes the roles of master storyteller and adept history instructor, prefacing each chapter with a six-part time line tracking innovative engineers, new materials and technology, pedagogy, design methods, design tools, and key buildings.

Addis tells even the much-repeated saga of how Brunelleschi sold church officials on letting him build his innovative dome with freshness and immediacy. He recounts tales of more obscure engineers, like Thomas Tredgold, author of a groundbreaking 1824 text on building ventilation and heating, so readers feel like their contemporaries, looking over their shoulders. Addis makes ancient inventions, many of which are the basis for contemporary architectural achievements, seem like today's news.

The book's subtext, underscoring the value of ever-evolving and sophisticated cooperation between architects and engineers, is conveyed through repeated accolades to Ove Arup, who Addis feels established the "gold standard" for such cooperation during design work on the Sydney Opera house. Apart from a few too many mentions of Arup at the expense of other modern engineers, the only flaw marring this magnificent achievement is Addis's regrettable myopia regarding building engineering achievements outside of the Western world. But there is enough for a lifetime of study between these covers. *Norman Weinstein*

Ove Arup: Masterbuilder of the Twentieth Century, *by Peter Jones. New Haven: Yale University Press, 2006, 352 pages, $40.*

Ove Arup
MASTERBUILDER OF THE TWENTIETH CENTURY
PETER JONES

Peter Jones paints a nuanced portrait of Ove Arup (1895–1988), a charming yet formidable giant, whose relentless pursuit of multidisciplinary collaboration was realized in such landmarks as the Sydney Opera House, London's Millennium Bridge and Channel Tunnel Rail Link, the Pompidou Centre in Paris, and Japan's Kansai Airport.

Trained as a philosopher and engineer, Arup had his idealism fanned by his contact with Bohemian intellectuals, the Bauhaus, Le Corbusier, and Russian émigré architect Berthold Lubetkin, his mentor. For Arup, art was "possibly the chief hope of mankind." But practical considerations, such as discovering that 89 percent of households in one postwar-London suburb had no bathroom, made him increasingly frustrated with architecture's abstract theories and reforms.

Arup & Arup, which he founded in London with his cousin Arne at the outset of World War II, prospered through national defense jobs: air-raid shelters, storage tanks, bridges, deep-water jetties. Jones provides fascinating insights into wartime building and postwar planning, both afflicted by the need for speed that propagated standardization at the expense of innovation. In 1946, after dissolving Arup & Arup, Ove founded a consulting practice that would become a partnership in 1949, and a vast global enterprise today.

Throughout his life, Arup was obsessed with creating the "composite mind"—formed of specialists who could synthesize a wealth of detail about materials, processes, and standards that no one architect, engineer, or contractor could master. He believed that only the widest cooperation from the earliest stage could yield architectural harmony.

Jones devotes three chapters to the contentious Sydney Opera House saga. Resolving the structure of Jorn Utzon's iconic roof shells propelled Arup onto a world stage, but his innovations were nearly eclipsed by the autocratic architect's romantic notions—budget and function be damned—of visual purity.

The narrative is peppered with the outsized personalities in Arup's wide circle—Freyssinet, Perret, Nervi, Candela, Mies, Wright—and masterfully situates them within the last century's structural and political discourse. Ultimately, Arup's legacy was not secured by engineering feats but by a working ethos that synthesized the highest aims of science and art and treated human beings as ends, not means. *Judith Dupre*

Materials for Design, *by Victoria Bell with Patrick Rand. New York: Princeton Architectural Press, 2006, 272 pages, $50.*

Authors Victoria Bell and Patrick Rand, both architects in Raleigh, North Carolina, argue that the "relationship between a project's aesthetics and its materiality" is more important than ever. After the faux veneers and antimateriality of Postmodernism, architecture is returning to its material roots—Mies's steel, Aalto's wood, Perret's concrete, and on to experimental plastic and metal alloys.

MATERIALS FOR DESIGN

In *Materials for Design*, the authors impart a thorough knowledge of glass, wood, concrete, metal, and plastic. A weighty tome, the book is a reference tool, complete with histories, production techniques, and each material's properties, along with case studies of new work. In short, this is the textbook that many of us wish we had in architecture school.

Each chapter begins with a material primer, design considerations, production techniques, and in the case of metal, charts on weathering, corrosion, and galvanization. Sixty case studies—illustrated with good photography, readable plans, and helpful construction details—show how inventive architects have put these materials to imaginative use. The projects range from a Rural Studio chapel made of Chevrolet windshields to Hans Peter Wörndl's plywood-panel house in Austria to Heikkinen and Komonen's Max Planck Institute in Dresden, where thermostatic resins were electrostatically bonded to aluminum cladding.

The book indicates that architectural technology is most advanced in Germany. Of the book's three-score buildings, a quarter are in Germany, with the U.S. and Australia tied for second. Holland, Austria, Switzerland, Spain, and Japan also field exciting examples, with single entries from the Czech Republic, Canada, Ireland, Poland, Chile, and Bolivia.

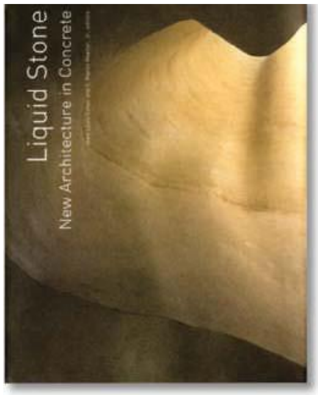
There is so much information in this book that the publisher had to employ an irritatingly small font. Nevertheless, *Materials for Design* is handsomely produced, and marks an otherwise auspicious start for Princeton Architectural Press's foray into technical titles. *William Morgan*

Liquid Stone: New Architecture in Concrete, *edited by Jean-Louis Cohen and G. Martin Moeller, Jr. New York: Princeton Architectural Press, 2006, 248 pages, $65.*

Liquid Stone, based on a National Building Museum exhibition curated by Martin Moeller, is a serious attempt to grapple with concrete's complicated history, rich present, and revolutionary future.

Concrete is both a material and a process; it is as old as the Romans and as new as the Modernism with which it is inextricably linked. Its surfaces can be as raw as Le Corbusier's *beton brut* or in the hands of Richard Meier, as smooth as glass. Wright called concrete a "mongrel" material, Paul Rudolph likened it to mud, and Louis Kahn thought of it as "molten stone." The negative associations of Brutalism ("Concrete," Nikolaus Pevsner declared, "with all the shuttering marks can never be attractive") have been forgotten, as concrete has become architecture's most ubiquitous and varied material.

This handsome volume offers stunning color photos of work by Tadao Ando, Antoine Predock, and Steven Holl, evolutionary successors to Breuer, Saarinen, and Pei. There is Norman Foster's breathtaking Millau Viaduct, representing the perfect union of engineering and art. Then there are the high-wire aerialists of contemporary concrete: Santiago Calatrava's wavelike auditorium in Tenerife, which is the Sydney Opera House reborn, and Zaha Hadid's Phaeno Science Center in Wolfsburg, Germany, which pushes concrete beyond known limits.



Beyond the dramatic images, excellent essays on concrete's history, development, and acceptance (or lack of it) give *Liquid Stone* its real heft. The book reminds us of the heroic early years of concrete, with pioneers such as Perret, Hennebique, and Freyssinet, and it follows Modernism's constant battle between architecture and technology. It may have been clear to Kahn that concrete really wants to be granite, but the many experimental iterations discussed in *Liquid Stone*'s closing chapter suggest a tremendously exciting future for concrete. *William Morgan*

Failed Stone: Problems and Solutions with Concrete and Masonry, *by Patrick Loughran. Basel: Birkhaüser, 2006, 159 pages, $70.*

Human beings have been building masonry structures since before recorded history. You'd think we'd have it figured out by now. But Patrick Loughran's new book on the problems that continue to crop up in building with stone, concrete, and other types of masonry—and how to solve them or avoid them altogether—demonstrates that there is still lots of room for improvement.

Loughran takes the high road by not dwelling on who is at fault, though it's always fun to read who really screwed up. And there have been some beautiful screwups. My favorite from this book is Finlandia Hall in Helsinki, designed by Alvar Aalto and constructed from 1967 to 1971. The architect selected Carrara marble. His flat rectangular marble panels, only 1¼ inch thick, didn't stay flat for long. On the east, west, and south sides, where thermal cycling of the cladding was most dramatic, they morphed into a basket-weave texture. By 1991, safety nets were installed to protect passersby from potentially fractured and falling stone, and work began to correct the problem. Because the Finnish government declared Finlandia Hall a protected landmark, whose appearance had to be kept "equivalent to the original," recladding (to the tune of more than 3 million euros) was done in the same stone as the original, and failed even faster the second time.

patrick loughran
failed stone
problems and solutions with concrete and masonry
Birkhäuser

Loughran recounts such failures to help those involved in making buildings treat stone and concrete with the care it deserves. He writes about the principles of materials and their proper use, and reconstructs how failures could have been avoided. Individual chapters cover thermal cycling, impact failures, efflorescence, surface defects, discoloration, corrosion, structural failures, and leakage. Each chapter concludes with lessons learned boiled down to bite-size pieces of information.

Failed Stone is informative, entertaining, and humbling, showing us why, after thousands of years of building with masonry, we still make mistakes. *Michael J. Crosbie*

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Nonprofit work experience: beneficial for all, but far too rare

Practice Matters

By Casius Pealer

Public and nonprofit practices are playing an increasing role in the professional development of young architects and yield great benefits for all concerned. The entrepreneurialism, close client contact, and quality design work achieved by those fortunate enough to obtain these positions make them desirable for traditional firms who want experienced interns. Yet the architecture profession does not support these unique training settings as thoroughly as professions such as law and medicine do, so both the interns who wish to gain this kind of experience, and those who are in need of services, go wanting.

Success stories

The Frederick P. Rose Architectural Fellowship is a national program that places architecture graduates in design positions with local nonprofit organizations for three years. "The common thread of the fellows' work is that they often make a project where there might not be a project otherwise" said Katie Swenson, FAIA, director of the Rose Architectural Fellowship and a former fellow herself. "In many ways, a nonprofit design experience is more entrepreneurial than working in a private firm would be."

The experience of Jamie Blosser, AIA, confirms this. Blosser spent three years as a Rose Fellow with the Ohkay Owingeh Housing Authority, a tribal housing authority located 25 miles north of Santa Fe, New Mexico. Her experience managing the development and construction of an affordable housing project, designed by Van Amburgh + Parés Architects, led to her current work as an associate and director of a Santa Fe firm, Atkin Olshin Lawson-Bell Architects.

"My role as the owner's project manager was to write the grants, market and work with the equity investor, manage the budget, deal with the politics of getting approval, and oversee design and construction. This experience has given me a much bigger idea of our role as architects," she says. Now when hiring people, she looks for evidence of community-based or public work, or some greater sense of personal responsibility. "I want to see if they only look at conventional models in their life or if they have a broader perspective. That reflects on their design ability and work ethic."

Shaun Patchell, a 2005 architecture graduate, worked for one year at Florida Legal Services in Tallahassee, Florida, through a fellowship with Design Corps, a Raleigh, North Carolina–based nonprofit. His assignment was to implement a design for high-quality modular farmworker housing, even though the client who commissioned the design backed out before he arrived. "I had to find a new client to demonstrate this could work, so I started attending farm-worker meetings and making connections with farmers themselves. I was selling an existing design to a nonexistent client." Eventually, Patchell convinced a willing farmer to build 10 units, and more may be built in the future.

Rose Fellow Jamie Blosser, AIA, was the owner's project manager on Tsigo Bugeh Village, a 40-unit affordable-housing project in Ohkay Owingeh, N.M. She says it gave her "valuable experience looking at projects from the perspective of the client." She wrote grants, worked with investors, dealt with approvals and oversaw design and construction.

PHOTOGRAPHY: © JAMIE BLOSSER

Casius Pealer is an affordable-housing attorney at Reno & Cavanaugh in Washington, D.C. He was coeditor of ArchVoices *from 1999 to 2005.*

Patchell now works at KieranTimberlake Associates, a firm noted for its use of modular and prefabricated construction. His early experience rebidding the original farm-worker housing, and convincing potential clients to take on a new idea, will benefit him throughout his career.

Client contact

Young architects in nonprofit settings often receive a significant amount of direct client contact, which can be hard to get in early years with a large traditional firm. Louis B. Smith, AIA, is a senior architect at Commercial Builders & Architects in Charlotte, and chair of the AIA's Small Practitioners Forum. Early in his career, he learned to manage complex group dynamics while working on community development projects for a citizen's district council in Detroit. This was good experience for his current practice, doing design-build work for churches. "There is no substitute for learning how to educate a client without making them feel inferior," said Smith. "And this education process often happens in a community setting, where individual clients may be developing a project together for the first and last time."

Michael Pyatok, FAIA, of Pyatok Architects in Oakland, California, agrees with Smith, but for a different reason. He says, "Today, architectural practice requires healthy, able-bodied young people to plug in and become extensions of computers. That affects their willingness to stay in the field and to be energetic about design. Any opportunity for interns to be physically and emotionally involved with the consequences of their own actions is invaluable." Pyatok, whose practice includes significant affordable-housing work, hires interns who can demonstrate engagement in something larger than themselves. He believes they improve his firm's work environment and productivity.

Good deeds, good design

Good Deeds, Good Design is the title of a book edited by Bryan Bell, founder of Design Corps, that responds to the notion that the quality of nonprofit design work must inevitably be compromised. Max Bond, FAIA, a partner at New York's Davis Brody Bond and an architect noted for his interest in underserved communities, agrees with the premise of Bell's book. "I always thought that it is really an artificial separation. An interest in community and social issues in no way reduced my interest in design."

Bond should know. His early career mixed experiences at traditional firms with time spent working in Ghana's national construction company, as well as the Architects Renewal Committee of Harlem. He recognizes that he was afforded significant responsibility in those settings that young architects are typically not given. Bond's design work and thinking are more holistic as a result. He says when prospective employees are interviewed for his firm, "We try not to compartmentalize. We seek out employees who look at life a little differently."

Nonprofits in other fields

The architecture and engineering professions are unique in requiring a postgraduation internship that is typically completed entirely in a private firm setting. In other professions, providing for either a formal or informal internship is often done in conjunction with community or public service. Teaching hospitals, for example, help meet that profession's obligation to provide care to uninsured and indigent patients while simultaneously enabling recent graduates to gain significant practical experience. According to the Association of American Medical Colleges, teaching hospitals constitute only 6 percent of the nation's hospitals, but they provide nearly half of all hospital charity care. Although medical residents hold a limited license or permit to practice, they remain under professional supervision during their residency.

Blosser worked with Van Amburgh + Parés Architects on the Tsigo Bugeh Village project.

The legal profession does not require a formal internship, but recent graduates and their employers still confront the challenge of transitioning from an academic to a professional setting. The National Association of Law Placement estimates that 10 percent of 2006 law school graduates took what are typically one-year positions as judicial law clerks in federal and state courts. These clerkships provide invaluable direct experience for recent graduates in a public setting, and graduates with this public experience and perspective are highly sought after by private law firms.

Supply and demand

The design fellowships described above are the two most significant opportunities for young architects looking for these kinds of opportunities, yet together they account for less than 10 positions annually for approximately 4,000 professional degree graduates. Although specific data on the total number of architecture graduates taking design positions with nonprofit or community-based organizations does not exist, Beth Miller, who directs the Community Design Collaborative of AIA Philadelphia, argues that there is far more interest on the part of young people than there are opportunities supported by the profession. "There are lots of young people who would love to take a full-time job in a nonprofit," says Miller. The Collaborative recently established a full-time position of its own for a design fellow, but can support just one fellow on a two-year rotation.

One of Miller's goals for the Collaborative is to expand the demand for full-time architectural services by community-based organizations. She does this in part by changing the perception of the role architects play. "Many organizations tend to hire design services as consultants, on a case-by-case basis," says Miller. "We try to get the ones we work with to see the value of having an architect on their board or even on their staff, to encourage a better understanding of the role of design in their community revitalization efforts."

In addition to changing the perceptions of potential clients, nonprofit experiences can be useful for interns in broadening their own views of what architects can and should do. Leslie Norvell agrees. Norvell is a landscape architect who has spent time volunteering for Miller's Community Design Collaborative and who works full-time in a local landscape-architecture firm, Lager Raabe Skafte Landscape Architects. "It's one thing to watch someone else do something and think, 'Oh, I would do this differently.' And it's another thing to be in the hot seat yourself."

Given the concerns often expressed by architects about the transition from education to practice, there would seem to be significant potential for the profession to formalize positions for young architects to work in community settings. The fact that other professions have institutionalized this kind of practical training of recent graduates to meet community needs implies that the architecture profession may have a duty here as well as an opportunity. In the meantime, individual interns and the firms that hire them will continue to seek out and benefit from singular experiences in local nonprofits.■

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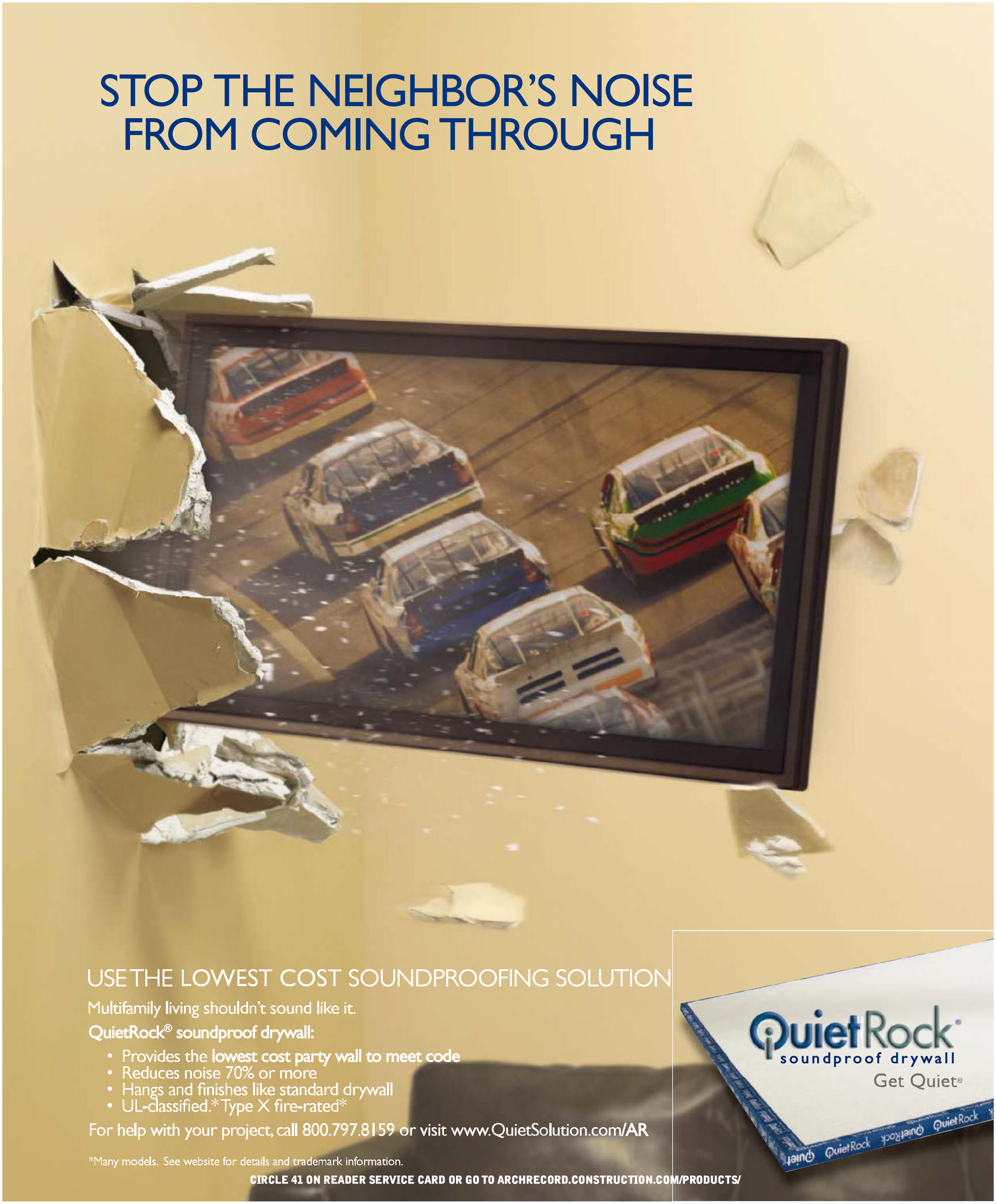

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Trade Show Review Milan • Salone del Mobile

Walking the rows of this renowned furniture fair, held this year during an uncomfortably warm week in mid-April, it's easy to spot the latest work by the industry's top product designers, many of whom are also architects. For a roundup of the accompanying Euroluce exhibition, see page 181. *Rita Catinella Orrell*

1 Plastic pushers Made of clear or translucent dyed polycarbonate, Thalya, by Patrick Jouin (right), utilizes a gas injection technique to give the plastic new levels of strength while keeping it lightweight. The Mr. Impossible chair (center), by Philippe Starck with Eugeni Quitllet, is created by welding a transparent structure to a clear or colored seat shell, resulting in a surprising design effect. Toobe, the company's first floor lamp, is made of a PMMA extruded tube. Designed by Ferruccio Laviani, the lamp is "faded" through a special coloring technique, allowing light to be diffused within the cylinder. Kartell, New York City. www.kartell.it **CIRCLE 200**

2 Leather-mesh screen An evolution of last year's coach-hide-mesh Loom chair, the Loomy screen is designed by Franco Poli. Two elliptical metal frames hold the coach-hide mesh in place, creating a 3D, self-supporting partition. The screen creates separate areas without obstructing views and is ideal for residential, office, or retail applications. M2L Inc., New York City. www.matteograssi.it **CIRCLE 201**

3 Leaves and webs Among other new features, the Storage system by Piero Lissoni and Porro now offers coplanar electric leaves to make the opening movement faster and easier, while new transparent glass leaves enclosed in a thin iron profile allow for clear interior views. Also from Porro is an updated version of Synapsis, a lightweight table designed by Jean-Marie Massaud that features a web of welded metallic tubes that delicately support a wooden top. Boffi USA, New York City. www.porro.com **CIRCLE 202**

4 Origami folding chair The Isis folding chair folds completely flat when closed, and looks razor thin from the side. It features an easy close system, a natural wood frame, and plywood panels. Gebrüder Thonet Vienna, Tolentino, Italy. www.thonet-vienna.com **CIRCLE 203**

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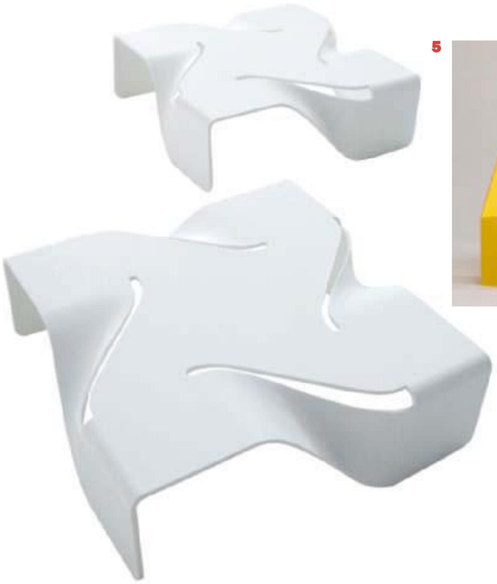

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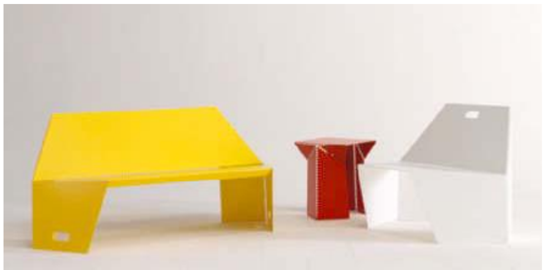

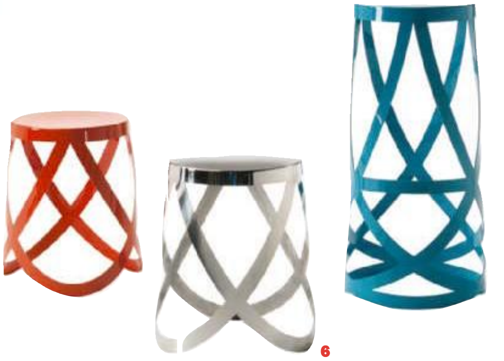

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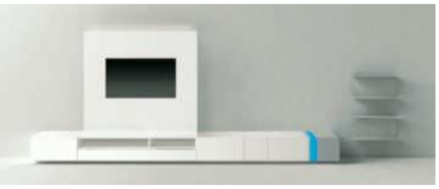

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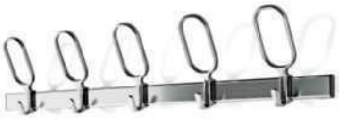

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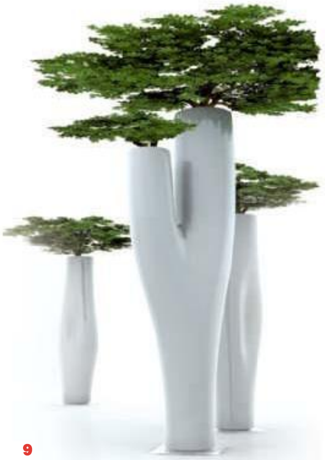

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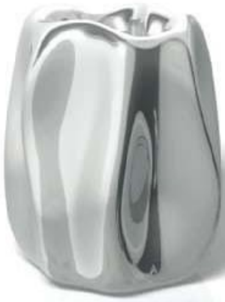

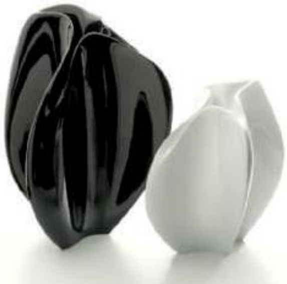

5 Bent and spun Vertigo (far left) is the first project for Moroso by Laura Aquili and Ergian Alberg, a partnership born in the London studio of Zaha Hadid. Inspired by M.C. Escher, the Corian table is designed to give the illusion of movement. Bent (near left), by Christophe de la Fontaine and Stefan Diez, is an addition to Moroso's outdoor collection. The colorful tables and chairs are made of laser-cut, bent, powder-coated aluminum. Moroso USA, New York City. www.morosousa.com **CIRCLE 204**

6 Decorative support The Ribbon stool, designed by Nendo, is made from laser-cut metal strips that both decorate and support. An upholstered seat cushion is attached via a magnet. Cappellini, New York City. www.cappellini.it **CIRCLE 205**

7 No static The Prime Time storage unit helps conceal the boxes and cables that clutter entertainment units by leaving the flat-screen television as the protagonist. All the boxes are placed inside containers equipped with cable channels for connections. Pallucco, Treviso, Italy. www.pallucco.com **CIRCLE 206**

8 Hanging around The Birds on a Wire wall coat hanger was designed by the hot British design duo Edward Barber and Jay Osgerby. It's made of an anodized-aluminum wall bar with hooks in polished die-cast aluminum or painted in polyester powder. Leif Petersen, Larkspur, Calif. www.magisdesign.com **CIRCLE 207**

9 Polyethylene planters Made of a polyethylene body and a brushed-steel base, the Missed Tree pot (center) by Jean-Marie Massaud comes in both a single body and a "branching" form. The sinuously shaped Flow pot (near left) by Zaha Hadid and Patrik Schumacher comes 6½' or 4' high in lacquered black or white. The New Wave planter (far left), by Ross Lovegrove, has a compact, liquid form in chrome, white, or black. Serralunga, Biella, Italy. www.serralunga.com **CIRCLE 208**

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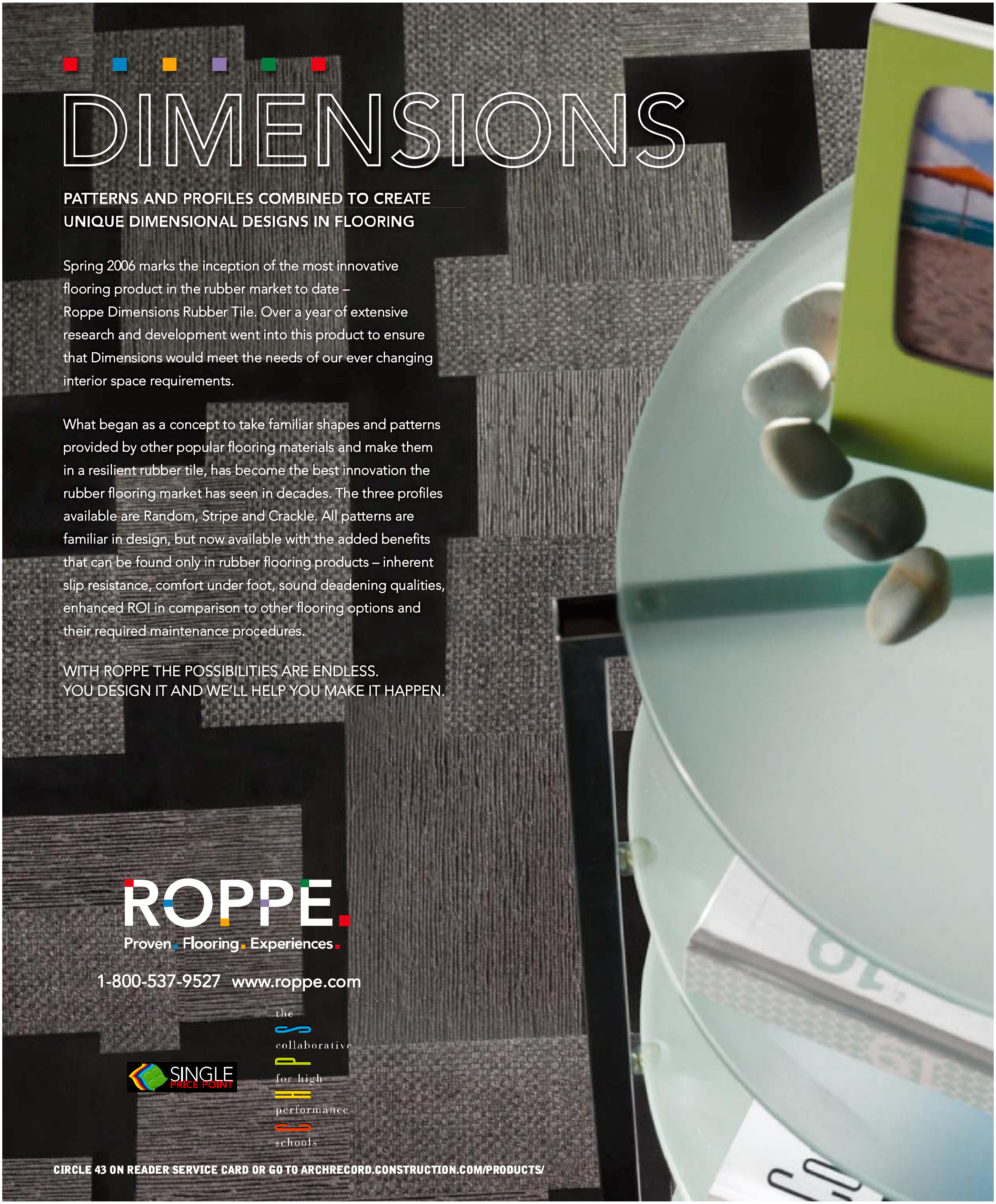

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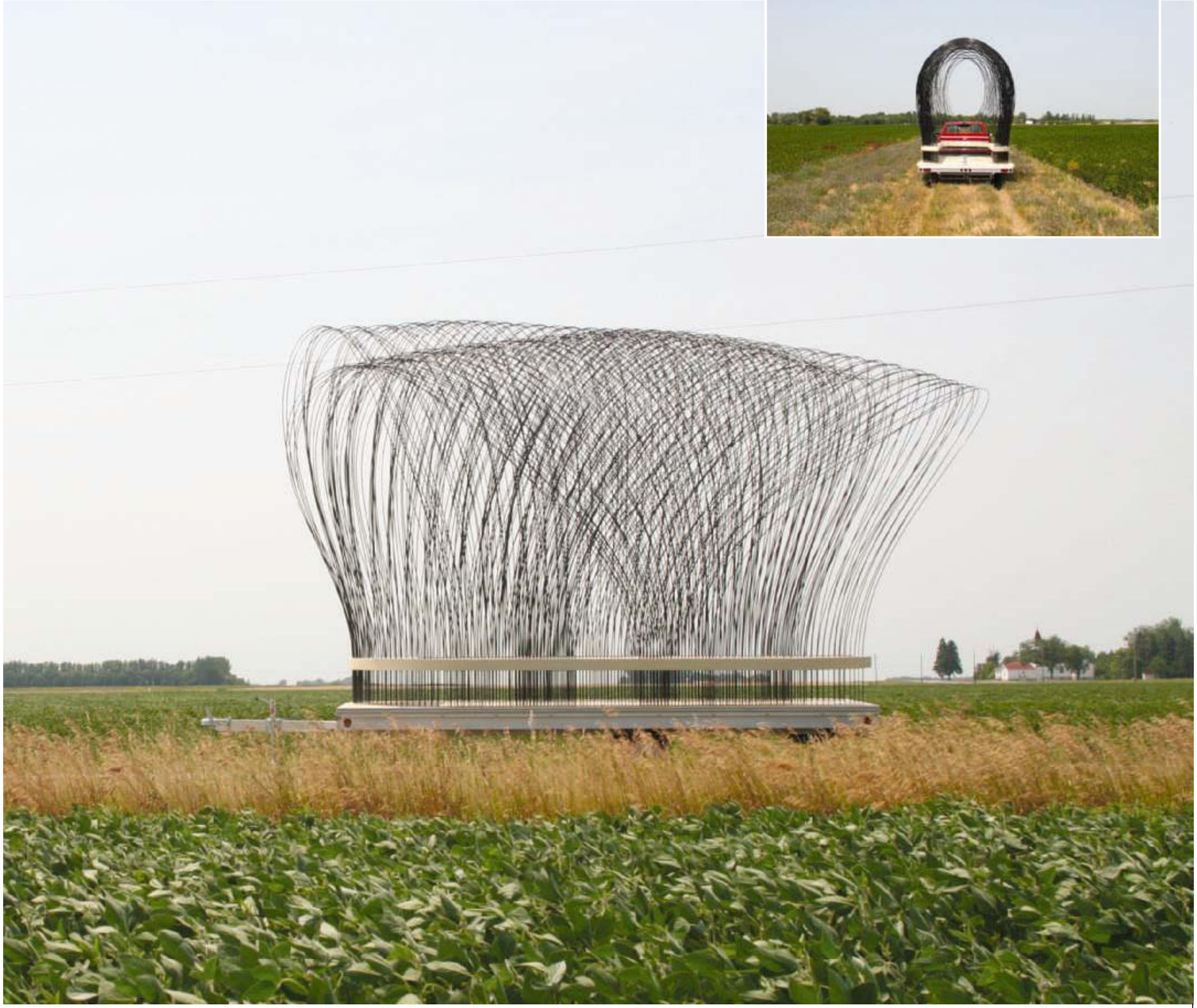


PHOTOGRAPHY: COURTESY MOORHEAD & MOORHEAD

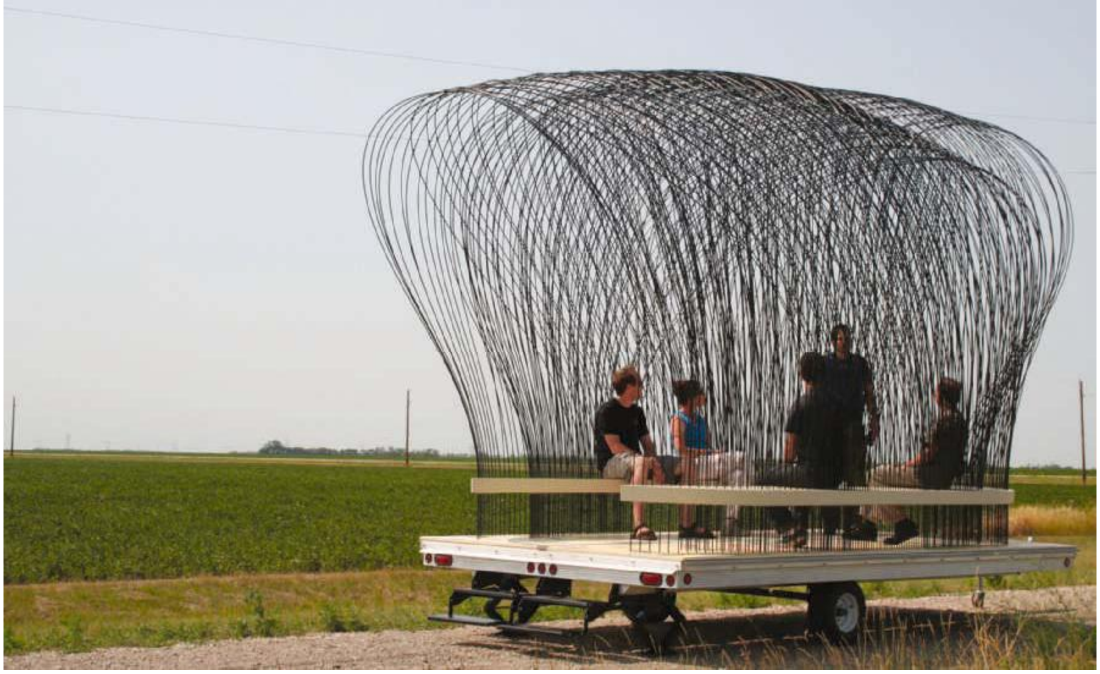
A family designs a little chapel on the prairie

By David Sokol

To raise a diaphanous, miniature chapel, Fargo, North Dakota architect Richard Moorhead raised a family first. Despite their mom's urging them to avoid the profession, Granger and Robert Moorhead cite their father for sparking their interest in design, and today the brothers, both in their thirties, are principals of their own architecture and industrial design firm, New York–based Moorhead & Moorhead.

Although father and sons are separated by half a continent and more than three decades, Granger says the Moorheads "share a core value system" that made an easy job of Mobile Chaplet, the trio's first collaboration.

In 2005, Fargo-based abstract painter Marjorie Schlossman launched the Roberts Street Chaplet Project, inviting Richard Moorhead and five other local architects to design small chapels that would be moved around the state by truck. Inspired by the Rothko Chapel in Houston, the



To create the Mobile Chaplet, Richard, Granger, and Robert Moorhead fashioned 200 thermoplastic composite rods into a double-canopy shape, inserting them through a floating bench and into a trailer deck.

spaces would feature Schlossman's work and would function as public contemplation areas—none of the art is for sale, and admission is free. Moorhead, remembering that his sons had worked on a small-scale project with the New York–based nonprofit public arts organization Creative Time, initiated a reunion.

The Moorheads sought inspiration from video footage taken of Schlossman in her studio. "I think of it as very loose and gestural," Granger says, describing how the artist interacts with her canvases. The team decided to express those broad, yet linear movements architecturally.

The younger men took the lead, tapping into a family of patterning concepts that Moorhead & Moorhead had been exploring. Their Filament Wound Bench, for example, features carbon fibers wrapped around a reusable core. Similarly, for the Mobile Chaplet, the designers decided to mount 200 30-foot-long, thermoplastic-composite rods into a 128-square-foot trailer bed and lace them into an abstract canopy shape.

Robert and Granger carefully plotted the rods' connection points, arranging them in inner and outer shells, but, Robert points out, "They were allowed to have a less specific relationship at the top of the weave." So while the core of the Chaplet comprises straightforward arcs, the rods along the edge take on more sinuous shapes. The final result—which the three men built together—not only references Schlossman's sweeping gestures, but also assumes the form of a church nave, a Conestoga wagon, or, from a distance, a stray thundercloud.

If North Dakotans are not reflecting on the architecture's myriad meanings, they can turn their gaze toward vistas framed by the permeable Mobile Chaplet. "The weaving has an engagement with the landscape while still feeling enclosed," Granger explains. Stressing that link, the rods run through a bench, supporting it with stainless-steel collars that make it appear to float like a second horizon line. Or, for another experience entirely, visitors can just look at their feet: For Schlossman's contribution, the client/artist painted an abstract landscape mural on the floor. ■

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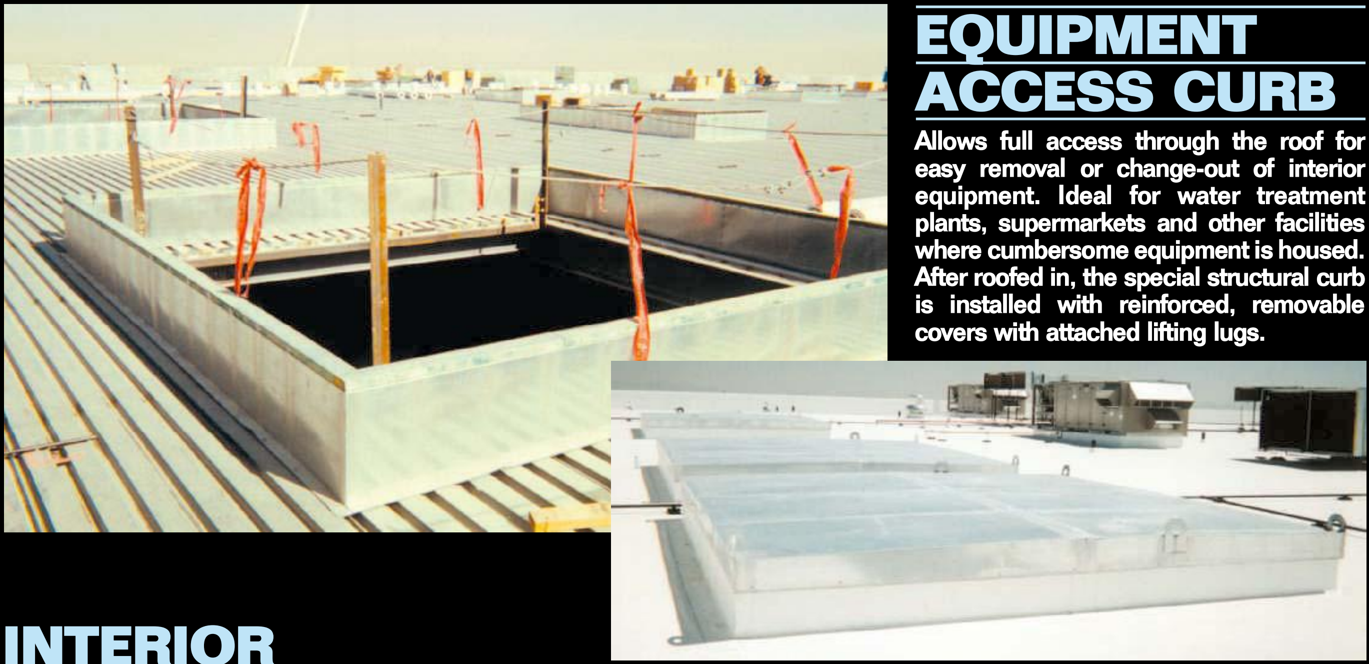

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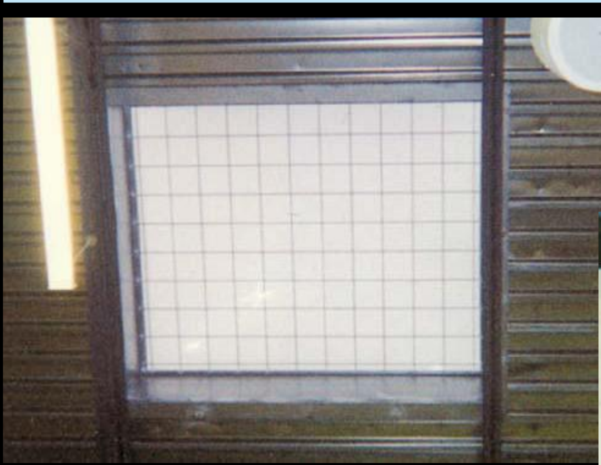

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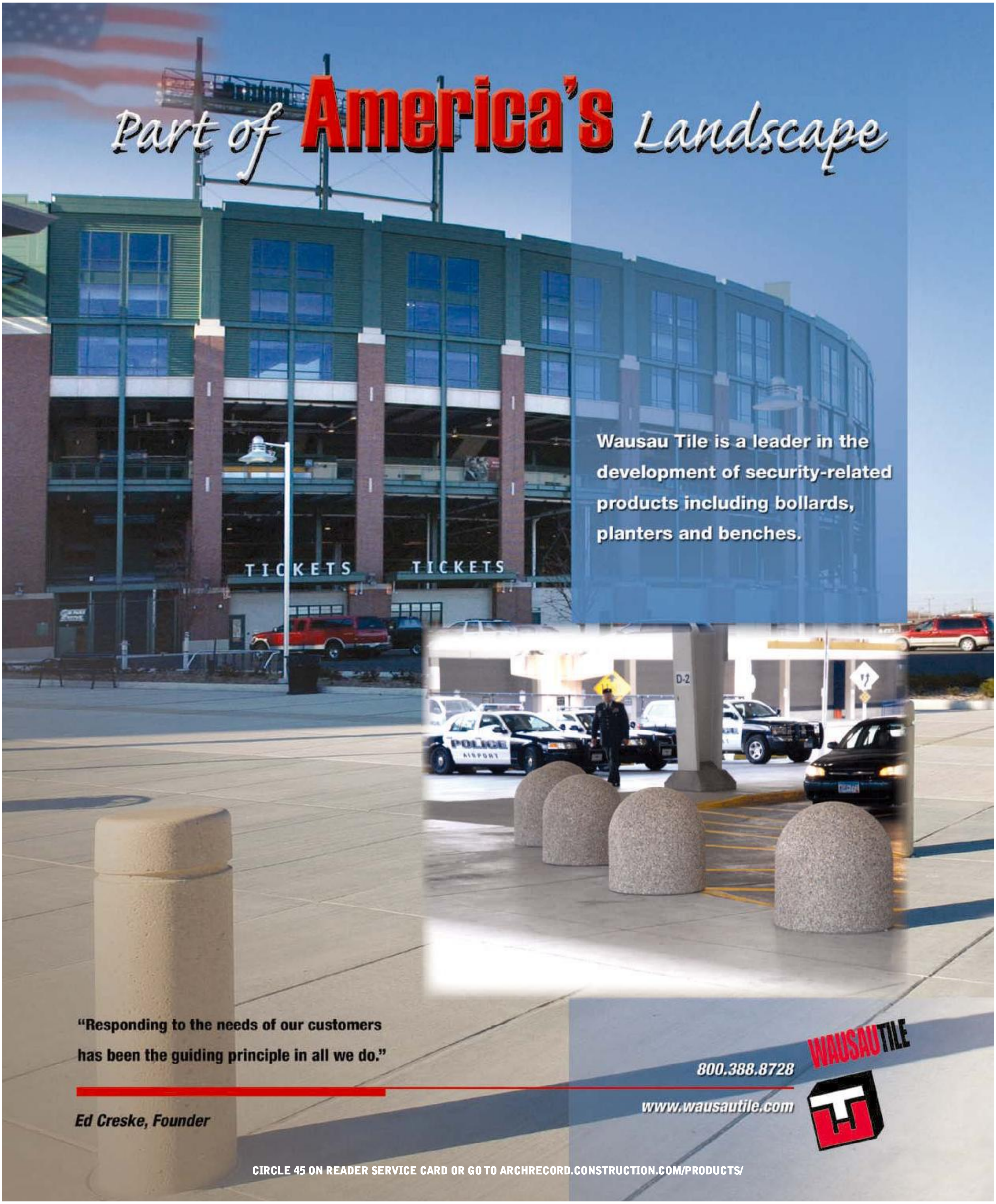

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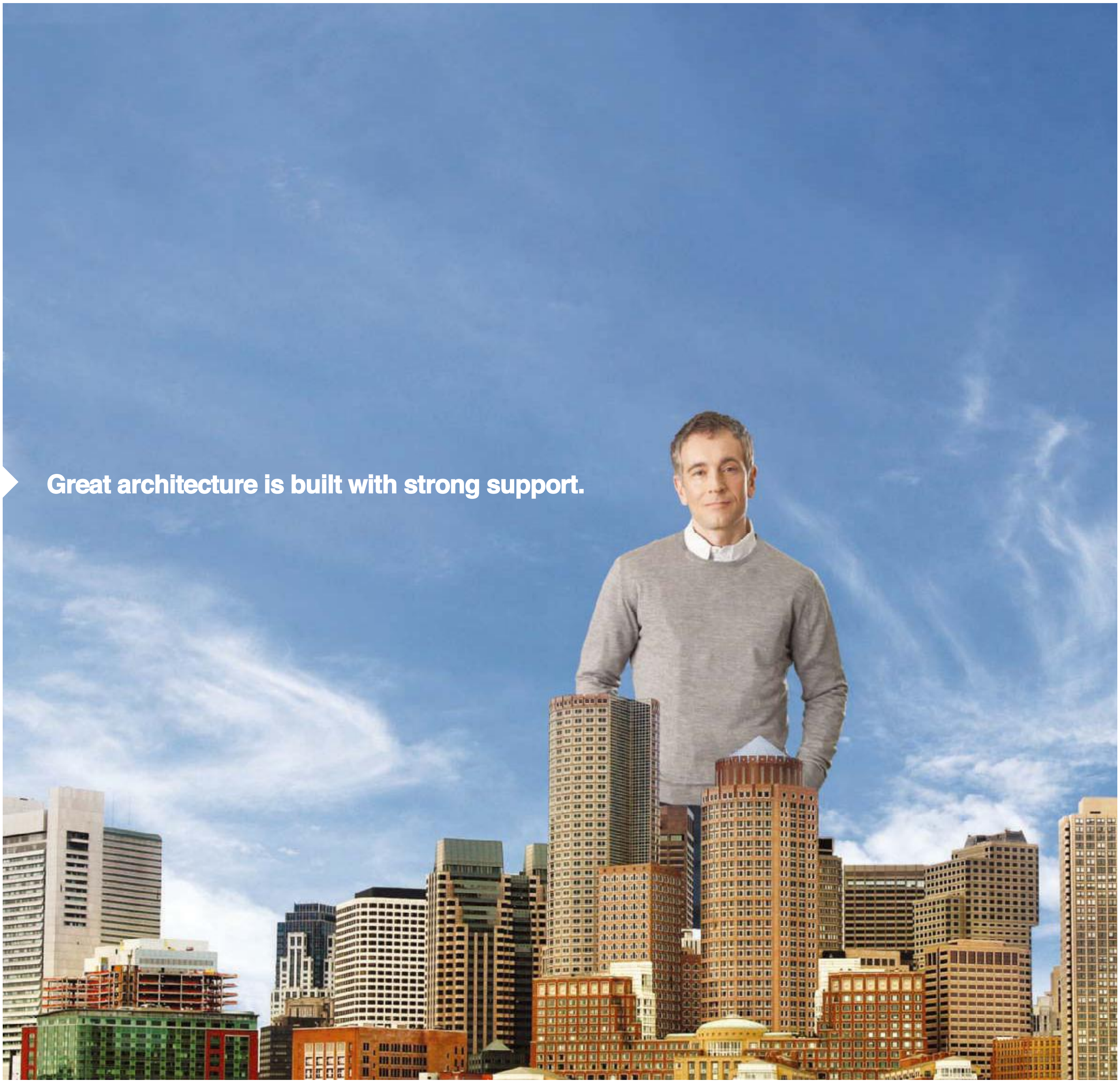
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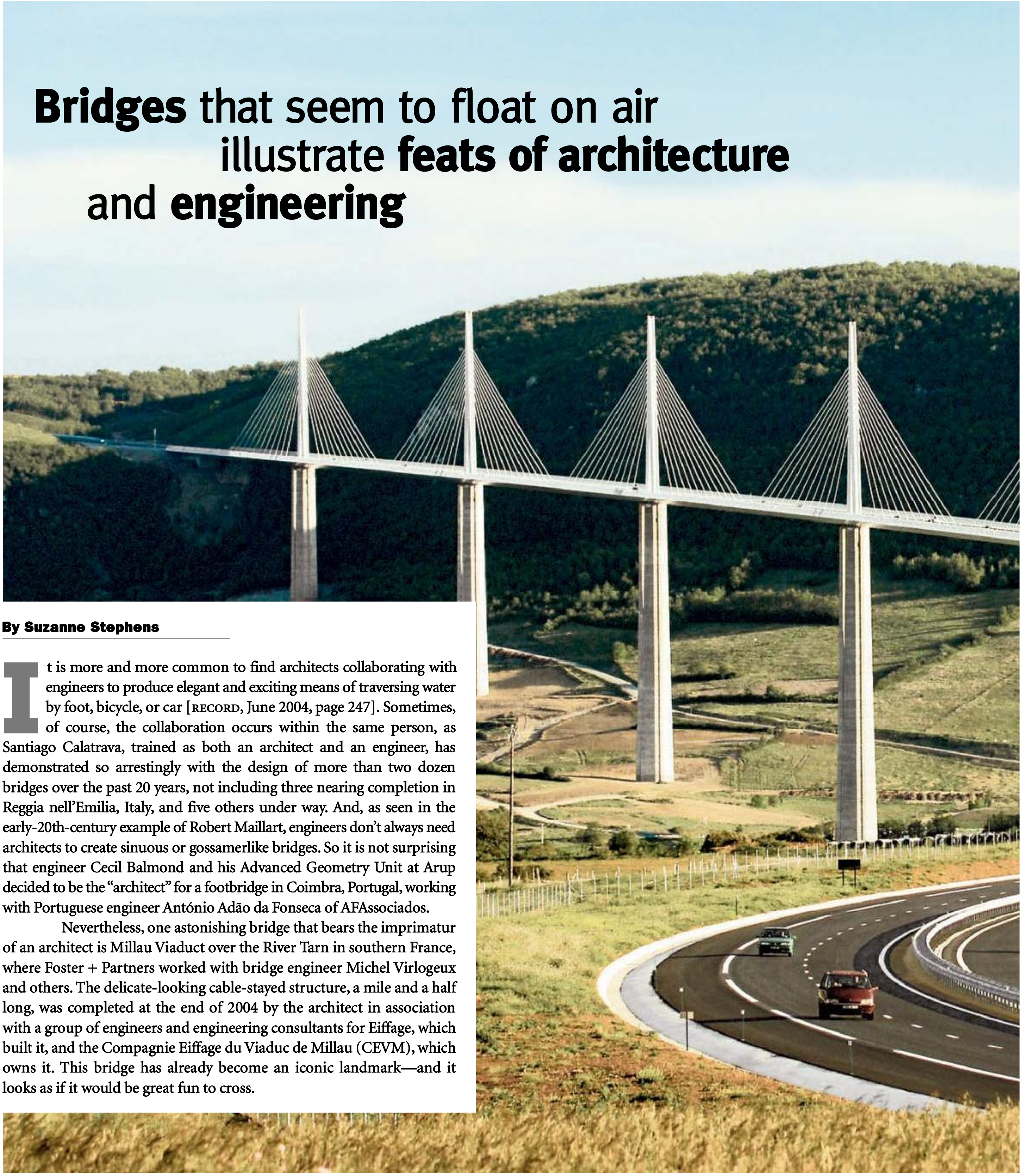
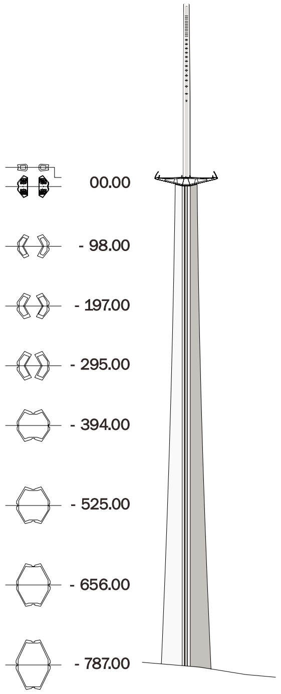
Bridges that seem to float on air illustrate **feats of architecture** and **engineering**



By Suzanne Stephens

It is more and more common to find architects collaborating with engineers to produce elegant and exciting means of traversing water by foot, bicycle, or car [RECORD, June 2004, page 247]. Sometimes, of course, the collaboration occurs within the same person, as Santiago Calatrava, trained as both an architect and an engineer, has demonstrated so arrestingly with the design of more than two dozen bridges over the past 20 years, not including three nearing completion in Reggia nell'Emilia, Italy, and five others under way. And, as seen in the early-20th-century example of Robert Maillart, engineers don't always need architects to create sinuous or gossamerlike bridges. So it is not surprising that engineer Cecil Balmond and his Advanced Geometry Unit at Arup decided to be the "architect" for a footbridge in Coimbra, Portugal, working with Portuguese engineer António Adão da Fonseca of AFAssociados.

Nevertheless, one astonishing bridge that bears the imprimatur of an architect is Millau Viaduct over the River Tarn in southern France, where Foster + Partners worked with bridge engineer Michel Virlogeux and others. The delicate-looking cable-stayed structure, a mile and a half long, was completed at the end of 2004 by the architect in association with a group of engineers and engineering consultants for Eiffage, which built it, and the Compagnie Eiffage du Viaduc de Millau (CEVM), which owns it. This bridge has already become an iconic landmark—and it looks as if it would be great fun to cross.

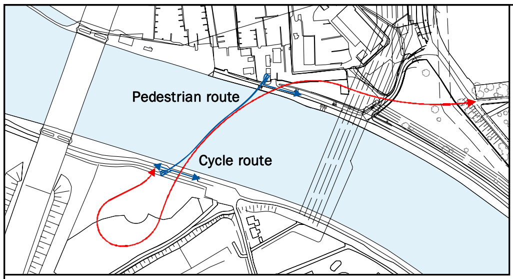


Millau Viaduct,
Millau, France,
Foster + Partners, et al

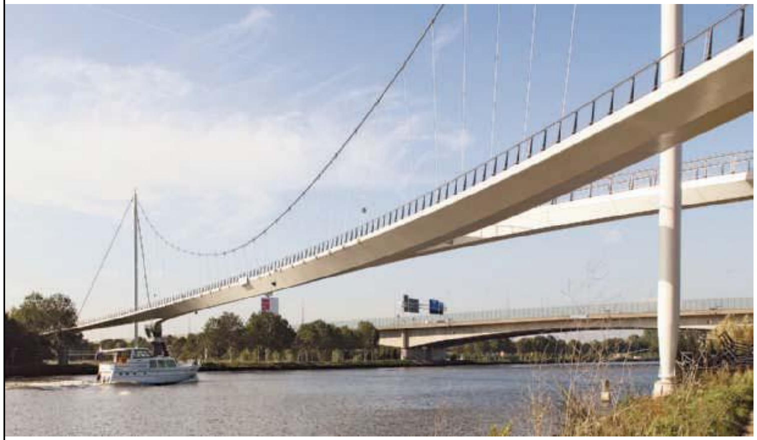
The competition-winning cable-stayed bridge owned by Compagnie Eiffage du Viaduc du Millau (CEVM) is the tallest automobile bridge in the world. Its seven concrete piers range from 256 feet to 800 feet in height, and steel pylons above the steel-box road bed add another 318 feet. Foster + Partners worked with advisers to CEVM, plus three Paris-based firms—Europe Etude Gecti, Thales Group, and Societé d'Etudes R. Foucault et Associés—on this 1½-mile-long bridge, where 11 pairs of cables support each of eight spans.

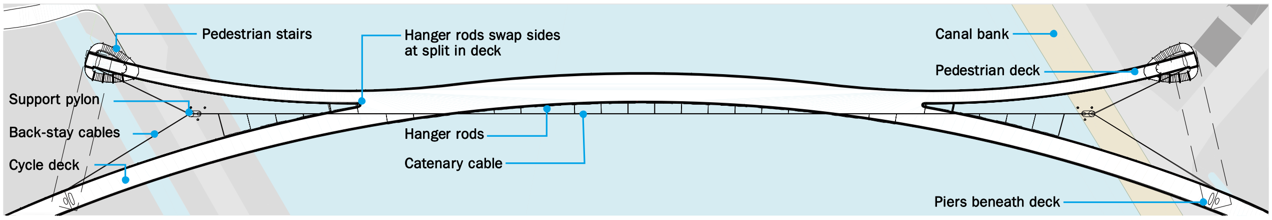
Nesciobrug,
Amsterdam, the Netherlands,
Wilkinson Eyre/Arup/Grontmij

In designing a pedestrian and bicycling bridge outside Amsterdam in 2006, the London-based architects Wilkinson Eyre worked in association with Arup's structural engineers and Grontmij (specialists in concrete work). The Nesciobrug (Nescio Bridge), the first suspension bridge in the Netherlands, spans 535 feet (2,559 feet including approaches). It links the new suburb of IJburg being developed on reclaimed land to the city of Amsterdam. In order to keep the bridge from being too assertive in the landscape, the architects and engineers decided on the monocable, self-anchored suspension structure that gracefully curves and splits as it crosses the Rijn Kanaal. The two forms of traffic are guided along diverging paths, 11 feet wide for cyclists, and 7 feet for pedestrians. A curved, steel box girder provides the deck for the bridge, which allows a clearance of 30½ feet beneath it for commercial shipping. Each of the separate decks continues beyond the masts, with back-stay cables supporting them.

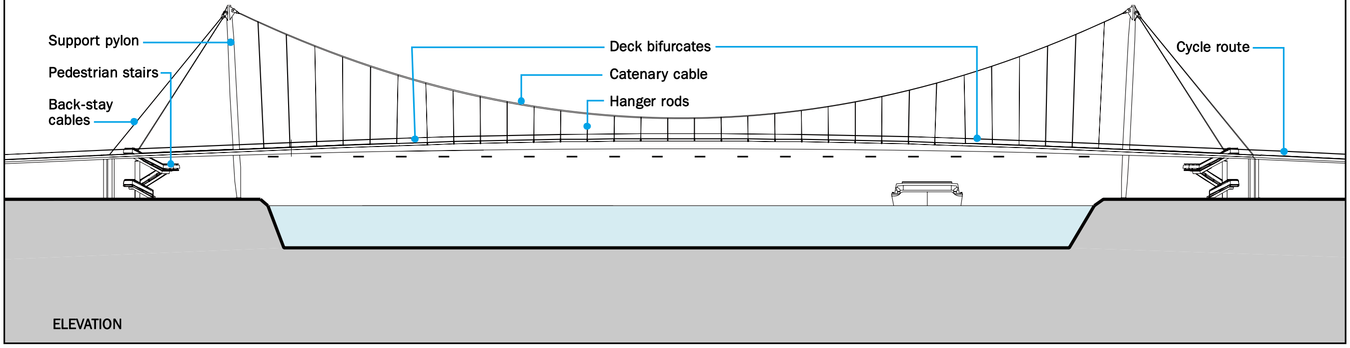

Pedestrian route
Cycle route

The bridge guides both pedestrians and bicyclists in separate sinuous paths across the Rijn Kanaal to link the new suburb of IJburg with Amsterdam.




Pedestrian stairs
Hanger rods swap sides at split in deck
Canal bank
Pedestrian deck
Support pylon
Back-stay cables
Cycle deck
Hanger rods
Catenary cable
Piers beneath deck

PLAN


Support pylon
Pedestrian stairs
Back-stay cables
Deck bifurcates
Catenary cable
Hanger rods
Cycle route

ELEVATION

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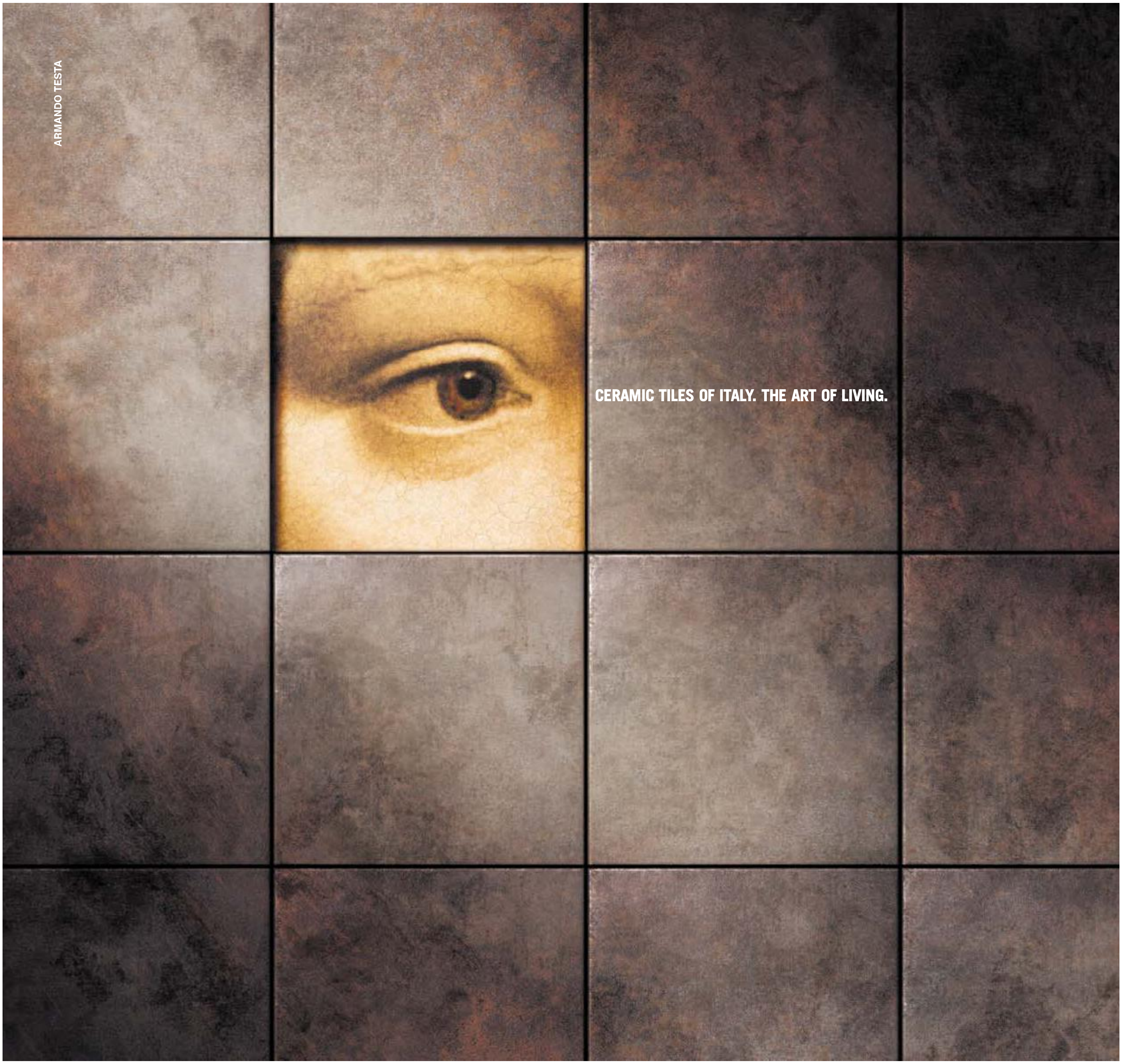
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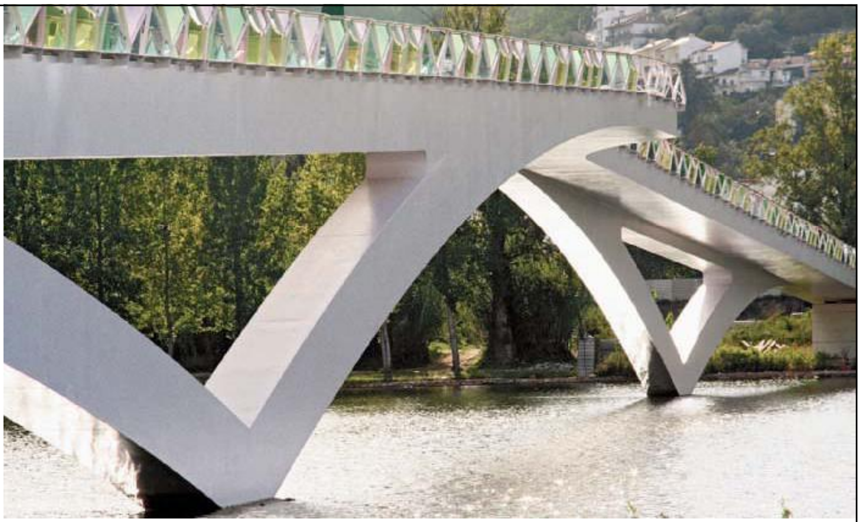
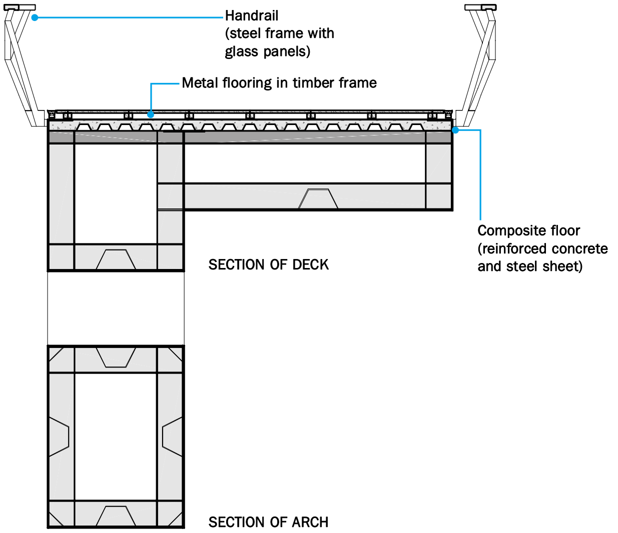
Footbridge, Coimbra, Portugal,

Cecil Balmond and António Adão da Fonseca

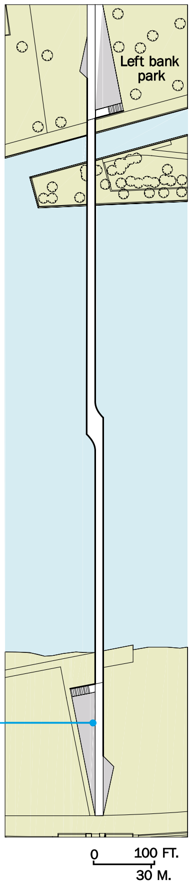
In designing a pedestrian bridge for the Rio Mondego near the town of Coimbra in central Portugal, the engineer Cecil Balmond of Arup's Advanced Geometry Unit in London acted as the architect, working with Portuguese engineer António Adão da Fonseca and AFAssociados. Named the Pedro and Inês Bridge, after an ill-fated romance of yore, the 266-foot-long bridge does not appear to meet in the middle. Balmond and Adão da Fonseca devised a solution where two cantilevered spans push against one another as they transfer opposing loads onto the arched piers. A central parabolic arch and two lateral arches of steel with reinforced-concrete piers and abutments form the structure, and wood surfaces the concrete and metal deck. While the basic form is reminiscent of Maillart's Rhine River Bridge at Tavanasa of 1905, this 2007 version, with its jog, definitely has a new twist. To top it off, Balmond designed a jagged balustrade featuring colored-glass facets in a steel framework.




Handrail
(steel frame with
glass panels)
Metal flooring in timber frame
Composite floor
(reinforced concrete
and steel sheet)

SECTION OF DECK

SECTION OF ARCH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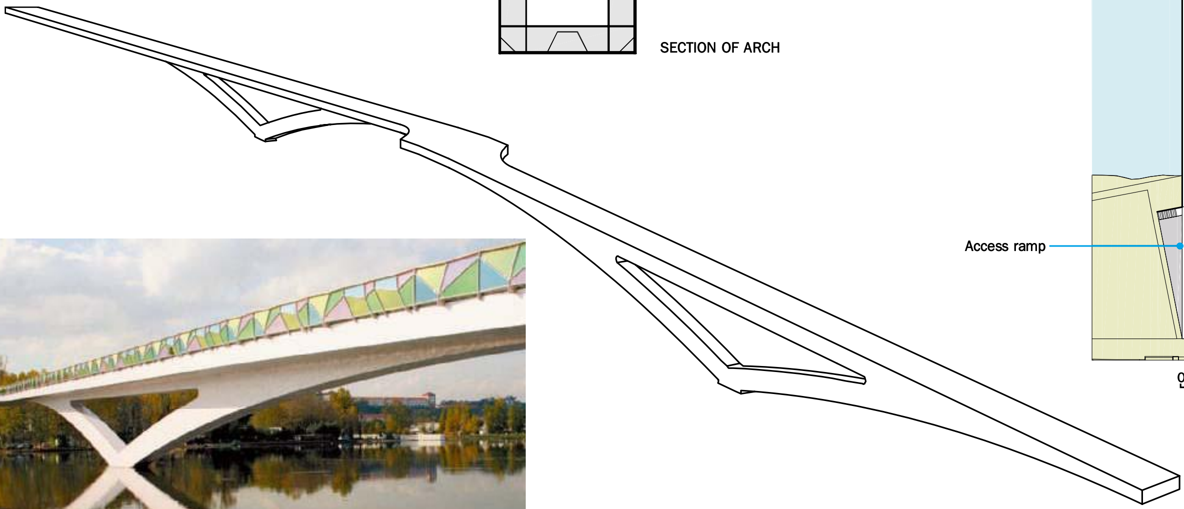

PERSPECTIVE OF BRIDGE MODEL

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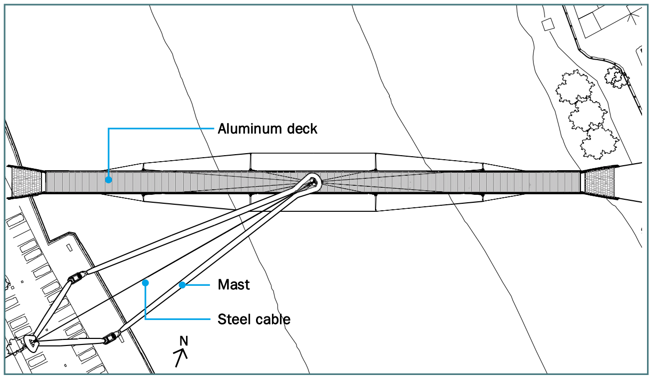
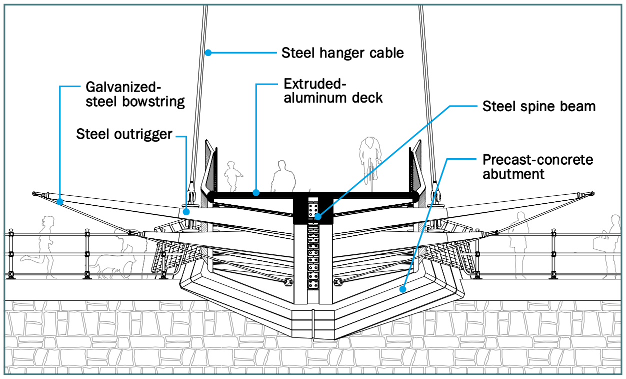
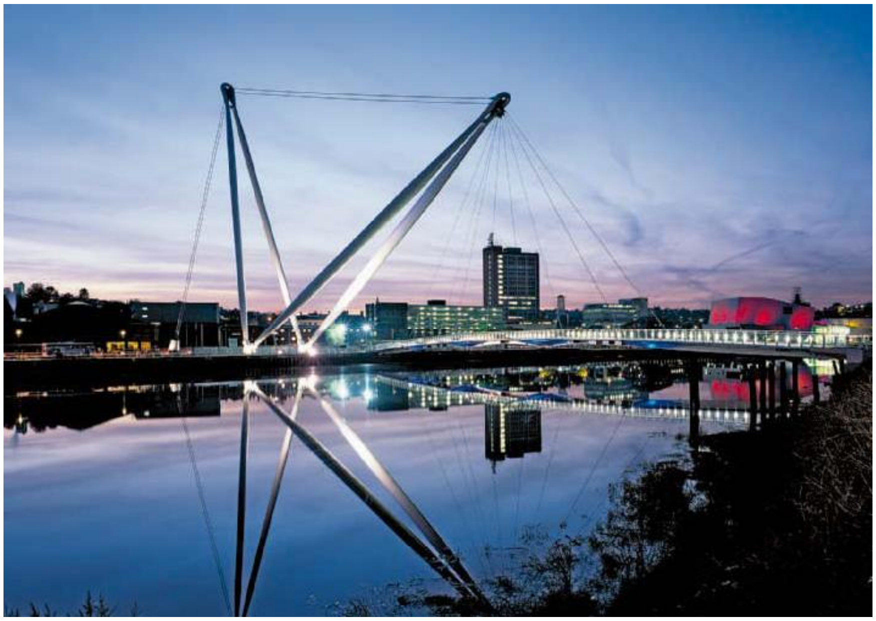
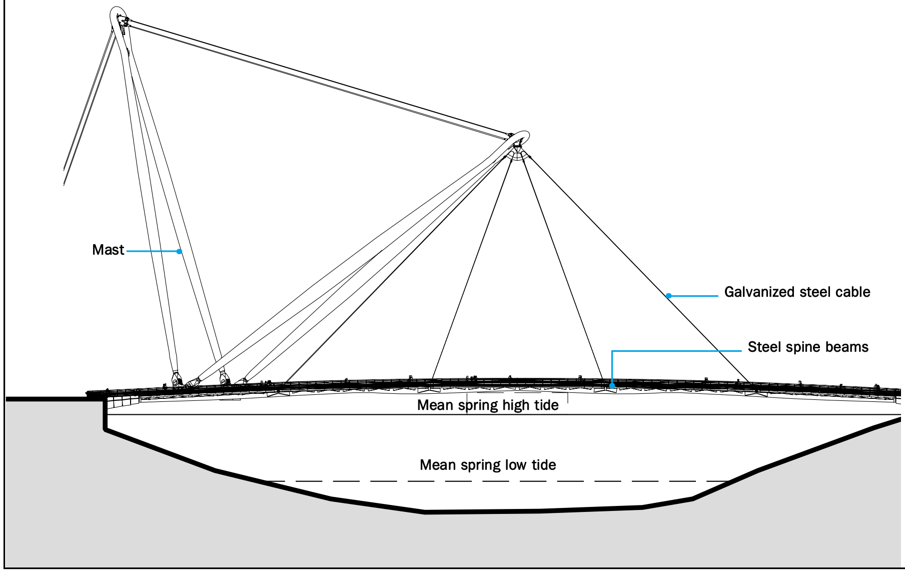

Aluminum deck
Mast
Steel cable
N


Steel hanger cable
Galvanized-steel bowstring
Extruded-aluminum deck
Steel spine beam
Steel outrigger
Precast-concrete abutment




Mast
Galvanized steel cable
Steel spine beams
Mean spring high tide
Mean spring low tide

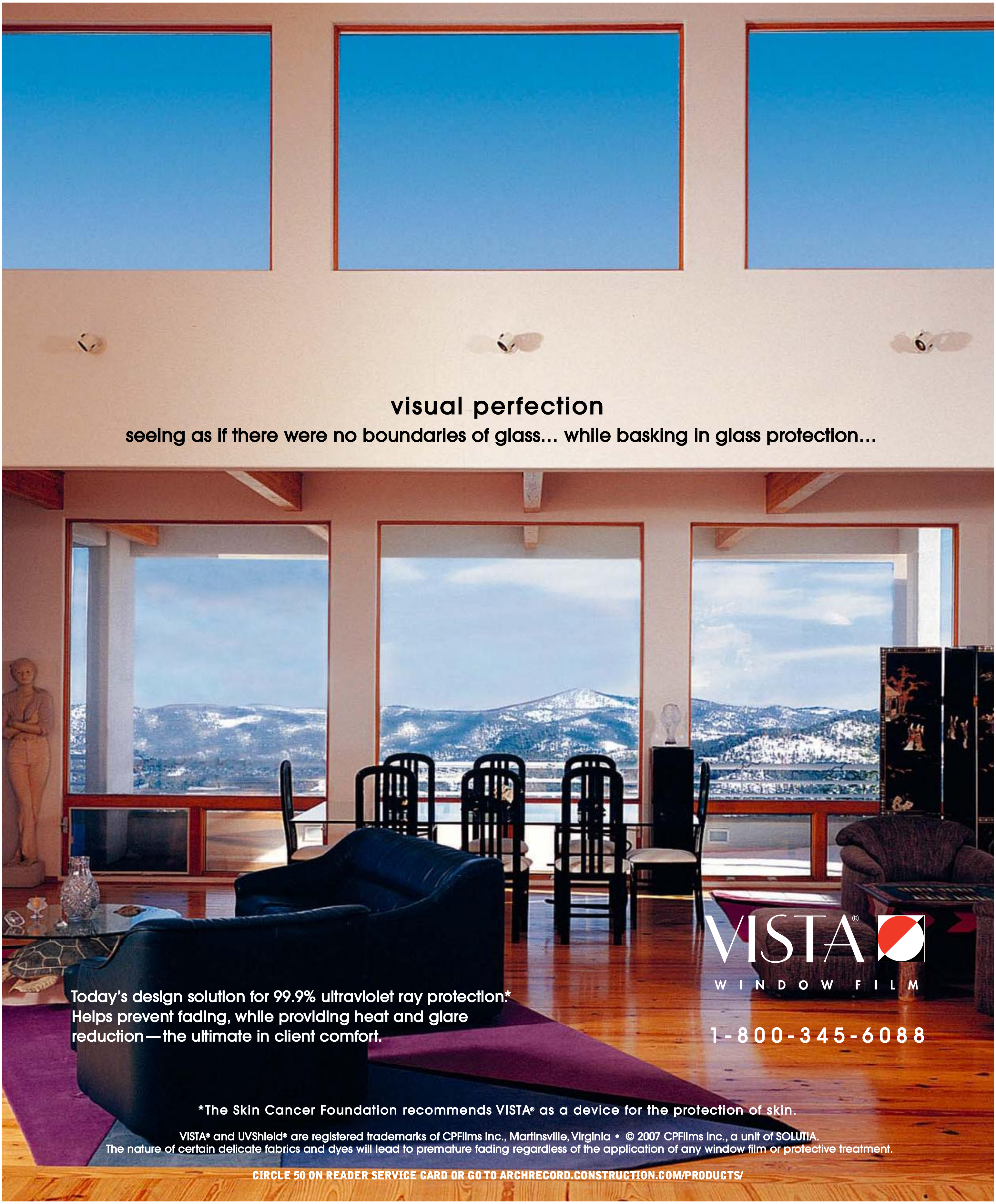
River Usk Footbridge,

Newport City, South Wales,

Atkins/Grimshaw/Alfred McAlpine

A competition-winning scheme for the design of a footbridge in South Wales employs a four-masted steel structure evocative of the sailing ships that long ago docked at the trading wharves of Newport City. The boatlike design, completed in 2006, resulted from the collaboration of a team where Grimshaw acted as a subconsultant to Atkins civil engineers, a firm employed by the contractor, Alfred McAlpine. The masts, which are paired on the west bank of the River Usk, support the 476-foot-long bridge deck, 16 feet wide, for pedestrians and bicyclists. The shape generates a dynamic presence on the river owing to the length of the masts: The forward mast extends 262 feet; the back mast, 230 feet. Cables, 5 inches in diameter and 260 feet long, transfer the deck's loads to the ground and act as back stays for the masts, while two precast-concrete abutments connect the bridge on the east and west banks of the River Usk.

PHOTOGRAPHY: © EDMUND SUMNER/VIEW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Working for You

2006 IN NUMBERS

In 2001, the AIA Board of Directors established a three-year plan to rebuild the organization's net assets. From the very beginning, through everyone's hard work and focus, the AIA has exceeded its targets year after year, returning the Institute more quickly than anticipated to sound financial health and maintaining momentum while developing new and effective ways to meet our strategic goals:

Increase member value

Be the authoritative source

Serve as the credible voice

Optimize organizational performance

Your dues at work

- Contract Documents introduced two new standard-form contracts: C160™-2007, Digital Data Licensing Agreement, and E201™-2007, Digital Data Protocol Exhibit to address transmission and control of digital data.
- The AIA is part of a coalition attempting to repeal a tax provision that would require the government to withhold 3 percent of all payments on government contracts, including design.
- Current TV, a global online television network, produced an eight-minute segment, titled "Green by Design," about the AIA Committee on the Environment's Top Ten Green Projects.
- A beta version of Soloso, the new collaborative knowledge tool under development, debuted at convention to get member feedback. Official launch is scheduled for fall 2007.
- Registration was more than 21,000 for the 2007 AIA National Convention in San Antonio which themed all workshops, seminars, and general sessions around sustainable design.
- Two microsites launched on the Web to educate prospective clients on working with an architect. See *http://howdesignworks.aia.org*.
- The AIA layers on Google Earth debuted in San Antonio, introducing large new audiences to an understanding of what architects do. One layer focuses on America's Favorite Architecture, and a second on Blueprint for America initiatives around the country.

We thank our members for their faith in the Institute and active participation in moving the profession forward to benefit your clients, communities, and the built environment. Look for more innovation and progress in the days and months ahead, but be assured that we continue to watch our fiscal performance as we act as stewards of our members' dues.

Christine W. McEntee
AIA Executive Vice President and Chief Executive Officer

AIA INCOME STATEMENT 2006 ($000'S)

	2006 Budget	2006 Audited Actual
Operating Revenue	$58,923	$58,974
Operating Expense	(57,639)	(55,688)
Operating Net Income	1,284	3,286
Investment Income	120	2,460
Total Net Income	**$1,404**	**$5,746**

AIA BALANCE SHEET ($000'S)

	Audited 2006	Audited 2005
Assets		
Cash	$ 2,977	$ 2,791
Investments	34,645	26,844
Accounts Receivable	3,548	2,197
Prepaid Expenses	1,744	1,529
Contributions Receivable (AIA150)	1,029	—
Inventory	3,034	2,399
Fixed Assets (Net)	5,907	7,171
Other Assets	665	750
Total Assets	**$53,549**	**$43,681**
Liabilities		
Line of Credit	$–	$–
Accounts Payable	7,676	5,311
Deferred dues and other revenue	11,694	10,063
Deferred Contract Doc Revenue	6,745	5,915
Notes Payable	13,427	14,131
Total Liabilities	**39,542**	**35,420**
Net Assets		
Unrestricted	9,827	5,474
Temporarily Restricted	3,442	2,049
Permanently Restricted	738	738
Total Net Assets	**14,007**	**8,261**
Total Liabilities & Net Assets	**$53,549**	**$43,681**

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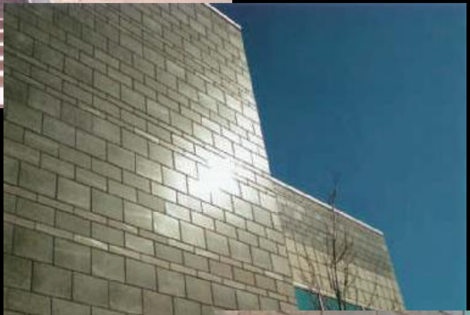

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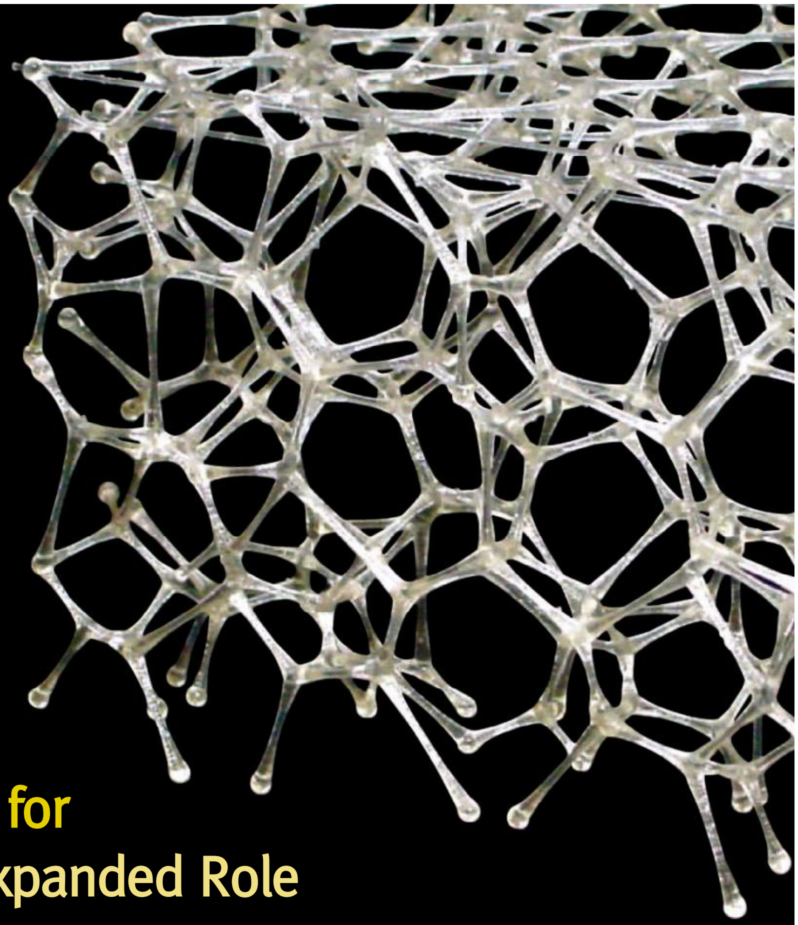

PTW Architects and Arup collaborated on the cellular steel structure (shown as a model) for the Watercube aquatics center currently in construction for the Beijing Olympics.

The Strange, New World for the Engineer's Expanded Role

INTRODUCTION

The "spectacular" architecture routinely featured in RECORD relies more than ever on the ingenuity, creativity, and yes, patience of the contemporary engineer. This species of professional, as much a creation of the modern era as anything else, now occupies a central place at the beginning of the design process, forever transforming how architecture relates to our cities, culture, and ourselves.

In this issue, we present a brief history of integrated design, focusing on the rise of the structural engineer. As part of that story, we feature an atlas of great mechanical and structural engineers—old and new—who have contributed substantially to architecture, either through built work, a philosophy of design, or a firm's legacy, as well as through collaboration. We also offer a collection of recent bridges illustrating a more traditional role of the engineer as designer.

Our August projects—San Francisco's Federal Building; Bangkok's airport; Lufthansa's headquarters in Frankfurt, Germany; and Portland, Oregon's aerial tram—all embody the principles of the new engineer, one who is willing to take risks to engage the realities of the changing environment and capable of thrusting new forms and technology into our world. We then offer an overview of recent skyscraper projects, and close with an exploration of the designs for New York City's newest subway line. Like the interconnected structural bubble frame of PTW Architects' and Arup's Watercube for the Beijing Olympics (above), we imagine the expanded role of the engineer will continue to supply architecture with limitless opportunity. *Russell Fortmeyer*

ESSAY

The Engineer's Moment

By Nina Rappaport

A shift in the architecture profession, already entrenched with issues of control and authorship, affords the engineer an expanded role during initial project design discussions, not just as consultants after the fact. Structural engineers like Chris Wise—formerly of Arup, now at Expedition Engineering—are literally drawing at the table, which is how he explains his collaboration at Arup with Norman Foster's office on London's Millennium Bridge. Engineers are featured prominently in conceptual design discussions, and they are even once again writing books on their philosophy of structures. The blurring of professional boundaries between architect and engineer is making the design process more flexible and malleable, and thus experimental, providing a new space for the structural engineer to merge the overemphasized divide between math, nature, technology, and design.

In part, this shift is due to a renewed interest in structures by contemporary architects, such as the Office for Metropolitan Architecture with Cecil Balmond, Michael Maltzan and Steven Holl with Guy Nordenson, Toyo Ito and Arata Isozaki with Mutsuro Sasaki, Coop Himmelb(l)au with Bollinger & Grohmann, to name just a few. This paradigm has emerged through intense collaboration, open design dialogue, and radical advances in digital design and fabrication technology, resulting in new arrangements of the "bones" of a building, the design of occupiable structural elements, new structural "skins" to envelop massive spaces, form-finding, and environmental integration. Structural designs that embrace a new holistic integration have also been inspired by the internal structures of nature, as found in things such as crystals, coral, and bones. Engineering falls between science and art, intuition and empiricism and is thus often not accepted in its full creative potential. Creativity results from intuitive interpretation of first principles of physics, mathematics, and code, which, while abstract, can result in new, nonstandard techniques in the physical world. Structure, so often only discussed in terms of economy and efficiency, is also about aesthetics.

In considering the rise of the contemporary engineer, what comes to light are three important moments of design input in the past century: the early Modern era; the 1950s; and again today, where geometry, structures in nature, and collaboration all play a role in shaping new spaces as described in this rather brief history. During the early Modern movement, the engineer came into the foreground, with or without architects, often patenting structural steel and concrete inventions for large spans, such as those by Owen Williams for Boots, Giacomo Matte-Trucco for Fiat, or the shell structures of Pier Luigi Nervi. Robert Maillart became a de facto Modern designer with his minimal bridge structures in Switzerland, as did the anonymous American engineers of grain silos admired by Erich Mendelsohn and Le Corbusier. The late London structural engineer Ove Arup started his career designing projects in concrete with Tecton Architects, such as London Zoo's Penguin Pool (1934), which Arup designed with engineer Felix Samuely.

Midcentury masters

Those Modern structural design engineers engaged the next generation, who by the 1950s and 1960s inserted themselves into larger consultancy roles for new building typologies, such as massive skyscraper projects. For example, Frederick Severud, with architect Matthew Nowicki, made possible the design of the suspended roof of the Raleigh Arena in North Carolina (1952). With its unique saddle shape, it fast became a pilgrimage stop for engineers Frank Newby, Ted Happold, and Frei Otto on their first visits to the U.S. in the early 1950s. Severud's ability to free structure to express the potentials of nonlinear space, breaking away from the rigid grid, also inspired Eero Saarinen's concrete shell for Ingalls Rink in New Haven (1956–59).

Ove Arup was also outspoken in his dedication to structure as a force for design, articulating in his landmark 1970 "Key Speech" concepts of "total design" and "total architecture." For Arup, these two points described a necessary and productive synthesis in the collaboration between architects and engineers, between design and construction. Although he died in 1989, his influence has been broad, not only through the 9,000 employees who constitute his present firm, but in the spawning of other firms, such as the late Ted Happold's Buro Happold, the late Peter Rice's RFR, Jane Wernick's firm, Chris Wise's Expedition Engineering, and Guy Nordenson, who started in Arup's New York office and then founded his own practice. While Arup has had lasting influence for the development of the multidisciplinary practice—structural, mechanical, electrical, plumbing, acoustics, lighting, and so on—Arup, the man, was never alone in his pursuit of structural innovation. The work of Jack Zunz on Jørn Utzon's Sydney Opera House in Australia (1957–73), which expanded the potential of shell structures, and Rice's work on the "high-tech" Centre Pompidou in Paris (1971–76), with Richard Rogers and Renzo Piano, both represent signatures for the firm at the time, as more individual engineers developed collaborative relationships with specific architects. Since 2005, engineers at Arup have been completing a precise 3D digital model of the Sydney Opera House for future construction projects and analysis.

In Germany, Frei Otto's collaborative investigations of lightweight structures took shape with the unique topographic roof surface of the Munich Olympic Park (1972), designed by Behnisch Architekten (then called Benisch + Partner), with engineers Leonhardt, Andrä and

Nina Rappaport is a writer, curator, and educator, as well as publications director at the Yale School of Architecture. Her forthcoming book, Support and Resist: Structural Engineers and Design Innovation, *is due this fall from The Monacelli Press.*

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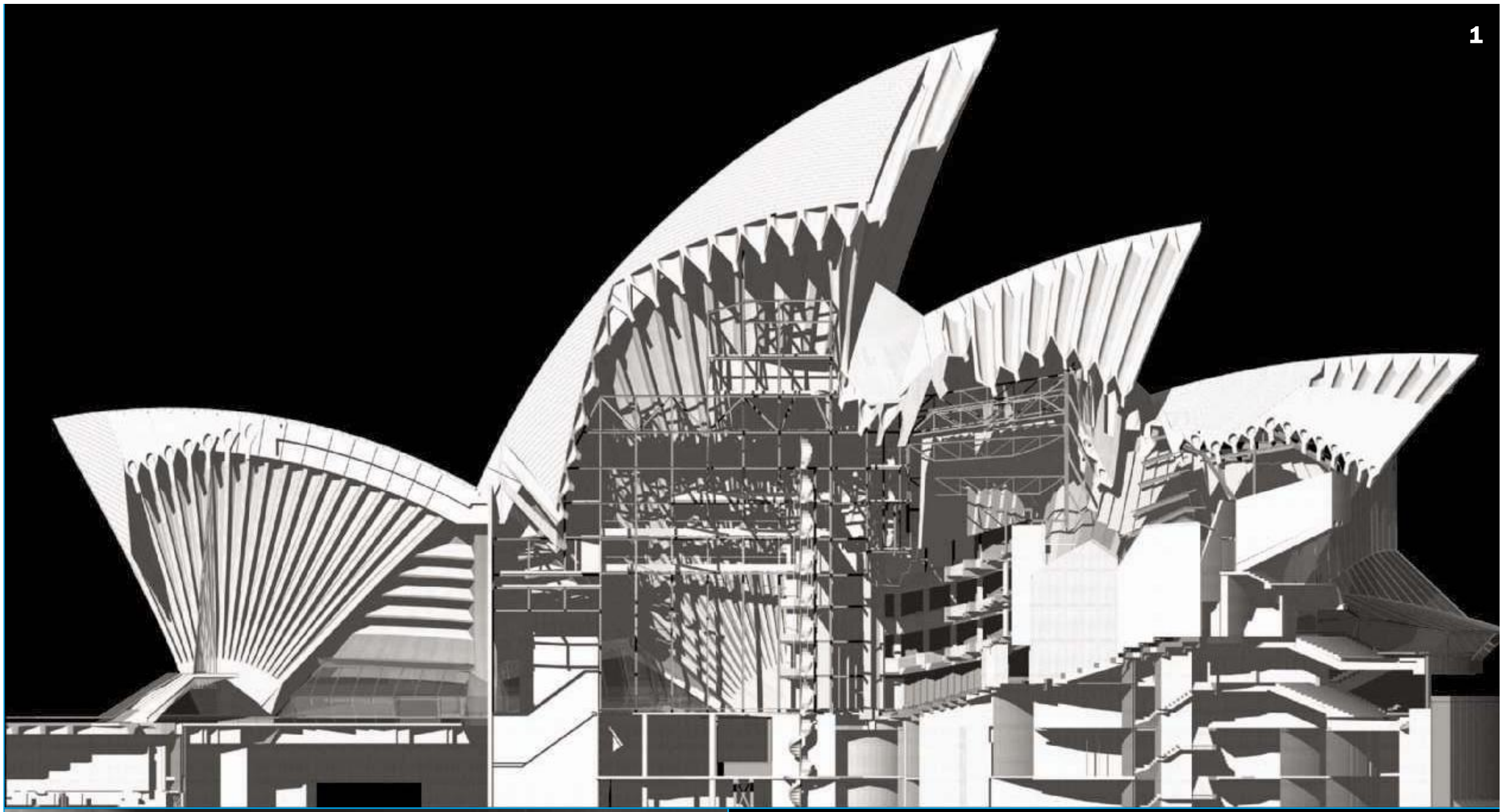
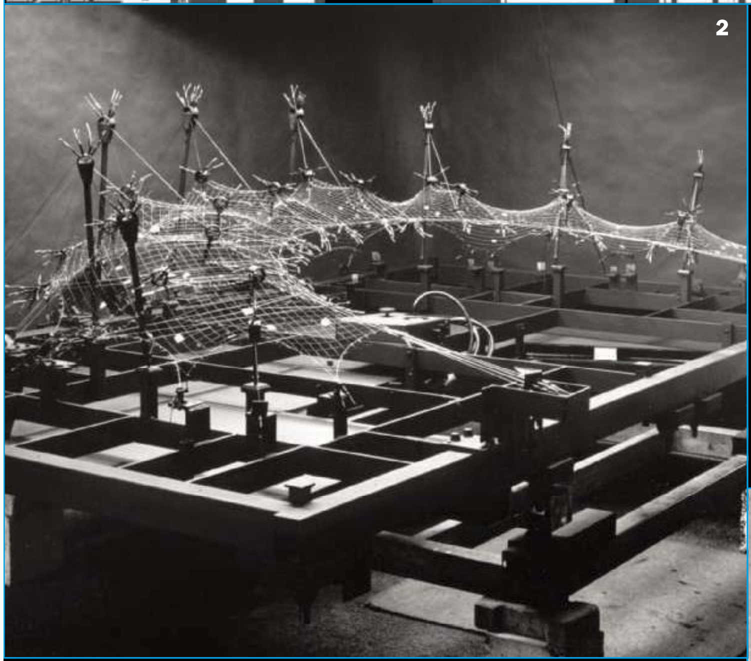
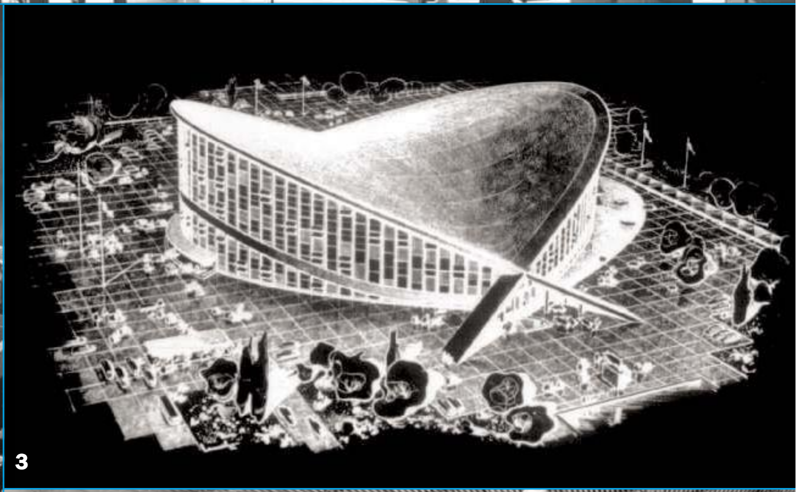
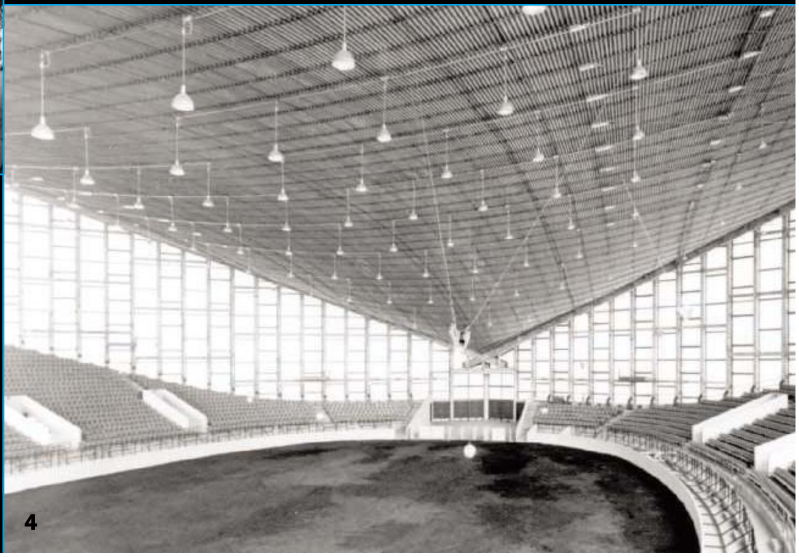








1. Building Information Model from 2007 of the Sydney Opera House (1957–73), *Jorn Utzon, with Ove Arup.*
2. Structural study model for the Munich Olympic Stadium (1972), *Behnisch Architekten, with Frei Otto.*
3, 4. Dorton (Raleigh) Arena (1952), North Carolina, *Matthew Nowicki, with Frederick Severud.*

EDITOR'S NOTE: Modern consulting engineers and their ideas have spawned countless new practices throughout the world, resulting in some of the most inspiring projects of our time. We admit we have left out a few greats in our overview, but we see this as only a beginning to understanding the increasingly interconnected world of architectural engineering.

London

JANE WERNICK
Jane Wernick and Associates, structural
Innsbruck Ski Jump, Austria (at Arup)
(Zaha Hadid Architects)

TIM MACFARLANE
Dewhurst Macfarlane, structural
Apple store's glass staircases
(Bohlin Ciwynski Jackson)

EDMOND HAPPOLD (D)
Buro Happold, structural
Tierpark Hellabrunn Aviary, Munich

IAN LIDDELL
Buro Happold, structural
Millennium Dome, London
(Rogers Stirk Harbour + Partners)

OVE ARUP (D)
Arup, structural
London Zoo's Penguin Pool
(Berthold Lubetkin)

JACK ZUNZ
Arup, structural
Sydney Opera House
(Jorn Utzon)

PATRICK BELLEW
Atelier 10, environmental
Singapore Arts Centre,
(Michael Wilford Associates)

ANTHONY HUNT
Anthony Hunt and Associates, structural
Eden Project, England
(Grimshaw Architects)

GUY BATTLE
Battle McCarthy, mechanical
Endesa Headquarters, Madrid
(Kohn Pedersen Fox)

CECIL BALMOND
Arup, structural
CCTV Tower, Beijing
(Office for Metropolitan Architecture)

NEIL THOMAS
Atelier 1, structural
Singapore Arts Centre
(Michael Wilford Associates)

HANIF KARA
Adams Kara Taylor, structural
Phano Science Center, Germany
(Zaha Hadid Architects)

CHRIS MCCARTHY
Battle McCarthy, structural
Elephant and Castle Eco-Towers, London
(Hamzah and Yeang)

PETER RICE (D)
Rice Francis Richie, structural
Centre Georges Pompidou, Paris
(Renzo Piano and Richard Rogers)

CHRIS WISE
Expedition Engineering, structural
Las Arenas Bullring, Barcelona
(Rogers Stirk Harbour + Partners)

CENTRE POMPIDOU

MARK WHITBY
Whitby Bird, structural
The Circle, London
(CZWG Architects)

Europe

PIER LUIGI NERVI (D)
(Italy), architect/structural
Cathedral of St. Mary of the Assumption, San Francisco
(Pietro Belluschi)

MATTHIAS SCHULER
Transsolar (Germany), mechanical/environmental
Deutsche Post, Bonn
(Murphy/Jahn Architects)

EUGENE FREYSSINET (D)
Campenon-Bernard (France), structural
Airship hangars, Orly, France
Innovated prestressed concrete

FREI OTTO
Atelier Frei Otto (Germany), architect/structural
Munich Olympic Stadium
(Behnisch Architekten)

MARC MIMRAM
Marc Mimram Engineers (France), structural
Solferino Bridge, Paris

JORG SCHLAICH
Schlaich Bergermann and Partner (Germany), structural
Munich Olympic Stadium
(Behnisch Architekten)

WERNER SOBEK
Werner Sobek Engineering and Design (Germany), structural
Mercedes-Benz Museum, Stuttgart, Germany
(UN Studio)

MICHEL VIRLOGEUX
(France), structural
Millau Viaduct, France
(Foster and Partners)

Institute for Lightweight Structures and Conceptual Design, University of Stuttgart

PIERRE LARDY (D)
(Switzerland), structural
Innovated prestressed concrete

ROBERT MAILLART (D)
(Switzerland), structural
Vessy Bridge, Switzerland
Innovated reinforced-concrete structures

BANGKOK AIRPORT

CHRISTIAN MENN
(Switzerland), structural
Felsenau Bridge, Switzerland
Further developed prestressed concrete

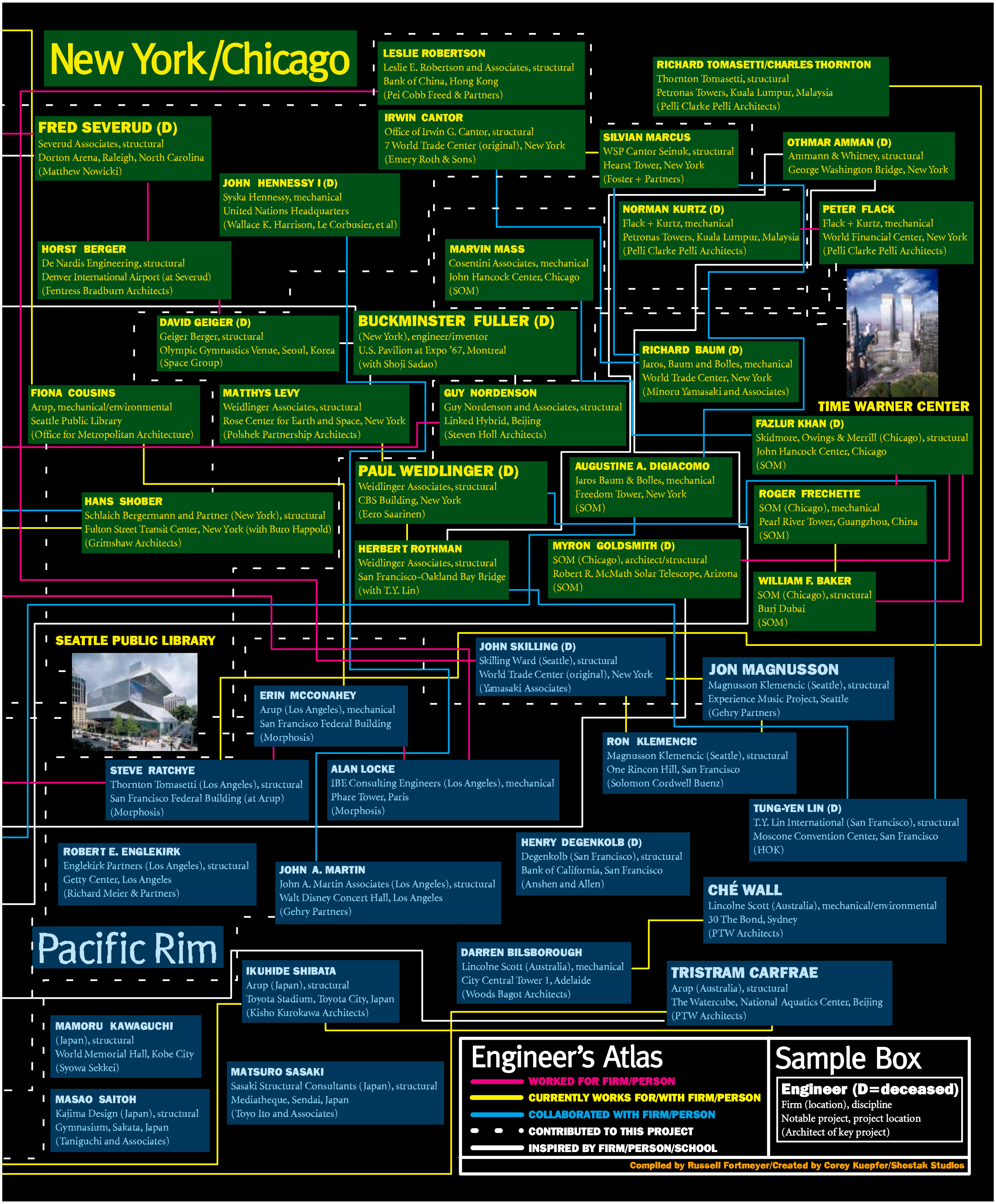
Swiss Federal Institute of Technology, Zurich

KLAUS BOLLINGER
Bollinger & Grohmann (Germany), structural
BMW Event and Delivery Center, Munich
(Coop Himmelb(l)au)

MANFRED GROHMANN
Bollinger & Grohmann (Germany), structural
BMW Event and Delivery Center, Munich
(Coop Himmelb(l)au)

HEINZ ISLER
(Switzerland), structural
Heimberg Indoor Tennis Center, Switzerland

JÜRG CONZETT
Conzett Bronzini Gartmann (Switzerland), architect/structural
Traversiner Footbridge, Viamala, Switzerland



New York/Chicago

LESLIE ROBERTSON
Leslie E. Robertson and Associates, structural
Bank of China, Hong Kong
(Pei Cobb Freed & Partners)

RICHARD TOMASETTI/CHARLES THORNTON
Thornton Tomasetti, structural
Petronas Towers, Kuala Lumpur, Malaysia
(Pelli Clarke Pelli Architects)

FRED SEVERUD (D)
Severud Associates, structural
Dorton Arena, Raleigh, North Carolina
(Matthew Nowicki)

IRWIN CANTOR
Office of Irwin G. Cantor, structural
7 World Trade Center (original), New York
(Emery Roth & Sons)

SILVIAN MARCUS
WSP Cantor Seinuk, structural
Hearst Tower, New York
(Foster + Partners)

OTHMAR AMMAN (D)
Ammann & Whitney, structural
George Washington Bridge, New York

JOHN HENNESSY I (D)
Syska Hennessy, mechanical
United Nations Headquarters
(Wallace K. Harrison, Le Corbusier, et al)

NORMAN KURTZ (D)
Flack + Kurtz, mechanical
Petronas Towers, Kuala Lumpur, Malaysia
(Pelli Clarke Pelli Architects)

PETER FLACK
Flack + Kurtz, mechanical
World Financial Center, New York
(Pelli Clarke Pelli Architects)

HORST BERGER
De Nardis Engineering, structural
Denver International Airport (at Severud)
(Fentress Bradburn Architects)

MARVIN MASS
Cosentini Associates, mechanical
John Hancock Center, Chicago
(SOM)

DAVID GEIGER (D)
Geiger Berger, structural
Olympic Gymnastics Venue, Seoul, Korea
(Space Group)

BUCKMINSTER FULLER (D)
(New York), engineer/inventor
U.S. Pavilion at Expo '67, Montreal
(with Shoji Sadao)

RICHARD BAUM (D)
Jaros, Baum and Bolles, mechanical
World Trade Center, New York
(Minoru Yamasaki and Associates)

TIME WARNER CENTER

FIONA COUSINS
Arup, mechanical/environmental
Seattle Public Library
(Office for Metropolitan Architecture)

MATTHYS LEVY
Weidlinger Associates, structural
Rose Center for Earth and Space, New York
(Polshek Partnership Architects)

GUY NORDENSON
Guy Nordenson and Associates, structural
Linked Hybrid, Beijing
(Steven Holl Architects)

FAZLUR KHAN (D)
Skidmore, Owings & Merrill (Chicago), structural
John Hancock Center, Chicago
(SOM)

PAUL WEIDLINGER (D)
Weidlinger Associates, structural
CBS Building, New York
(Eero Saarinen)

AUGUSTINE A. DIGIACOMO
Jaros Baum & Bolles, mechanical
Freedom Tower, New York
(SOM)

ROGER FRECHETTE
SOM (Chicago), mechanical
Pearl River Tower, Guangzhou, China
(SOM)

HANS SHOBER
Schlaich Bergermann and Partner (New York), structural
Fulton Street Transit Center, New York (with Buro Happold)
(Grimshaw Architects)

HERBERT ROTHMAN
Weidlinger Associates, structural
San Francisco-Oakland Bay Bridge
(with T.Y. Lin)

MYRON GOLDSMITH (D)
SOM (Chicago), architect/structural
Robert R. McMath Solar Telescope, Arizona
(SOM)

WILLIAM F. BAKER
SOM (Chicago), structural
Burj Dubai
(SOM)

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JOHN SKILLING (D)
Skilling Ward (Seattle), structural
World Trade Center (original), New York
(Yamasaki Associates)

JON MAGNUSSON
Magnusson Klemencic (Seattle), structural
Experience Music Project, Seattle
(Gehry Partners)

ERIN MCCONAHEY
Arup (Los Angeles), mechanical
San Francisco Federal Building
(Morphosis)

RON KLEMENCIC
Magnusson Klemencic (Seattle), structural
One Rincon Hill, San Francisco
(Solomon Cordwell Buenz)

STEVE RATCHYE
Thornton Tomasetti (Los Angeles), structural
San Francisco Federal Building (at Arup)
(Morphosis)

ALAN LOCKE
IBE Consulting Engineers (Los Angeles), mechanical
Phare Tower, Paris
(Morphosis)

TUNG-YEN LIN (D)
T.Y. Lin International (San Francisco), structural
Moscone Convention Center, San Francisco
(HOK)

ROBERT E. ENGLEKIRK
Englekirk Partners (Los Angeles), structural
Getty Center, Los Angeles
(Richard Meier & Partners)

HENRY DEGENKOLB (D)
Degenkolb (San Francisco), structural
Bank of California, San Francisco
(Anshen and Allen)

JOHN A. MARTIN
John A. Martin Associates (Los Angeles), structural
Walt Disney Concert Hall, Los Angeles
(Gehry Partners)

CHÉ WALL
Lincolne Scott (Australia), mechanical/environmental
30 The Bond, Sydney
(PTW Architects)

Pacific Rim

DARREN BILSBOROUGH
Lincolne Scott (Australia), mechanical
City Central Tower 1, Adelaide
(Woods Bagot Architects)

IKUHIDE SHIBATA
Arup (Japan), structural
Toyota Stadium, Toyota City, Japan
(Kisho Kurokawa Architects)

TRISTRAM CARFRAE
Arup (Australia), structural
The Watercube, National Aquatics Center, Beijing
(PTW Architects)

MAMORU KAWAGUCHI
(Japan), structural
World Memorial Hall, Kobe City
(Syowa Sekkei)

MATSURO SASAKI
Sasaki Structural Consultants (Japan), structural
Mediatheque, Sendai, Japan
(Toyo Ito and Associates)

MASAO SAITOH
Kajima Design (Japan), structural
Gymnasium, Sakata, Japan
(Taniguchi and Associates)

Engineer's Atlas

WORKED FOR FIRM/PERSON
CURRENTLY WORKS FOR/WITH FIRM/PERSON
COLLABORATED WITH FIRM/PERSON
CONTRIBUTED TO THIS PROJECT
INSPIRED BY FIRM/PERSON/SCHOOL

Sample Box

Engineer (D=deceased)
Firm (location), discipline
Notable project, project location
(Architect of key project)

Compiled by Russell Fortmeyer/Created by Corey Kuepfer/Shostak Studios

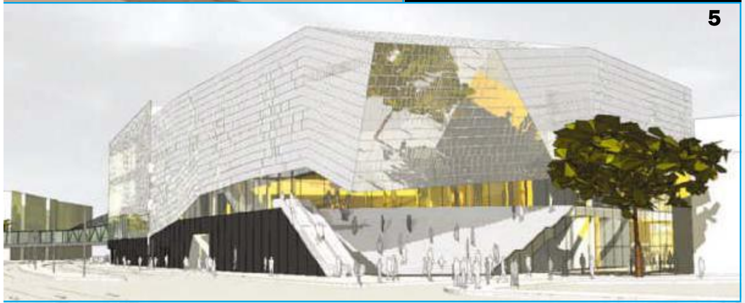
1

2

3

4

1. Crematorium (2006),
Toyo Ito and Associates,
with Matsuro Sasaki.
2. Ministructure No. 16 (2007),
Michael Maltzan,
with Guy Nordenson.
3. Novartis (2007),
SANAA, with Bollinger & Grohmann.
4. Mariinsky Theatre II (2008),
Dominique Perrault,
with Bollinger & Grohmann.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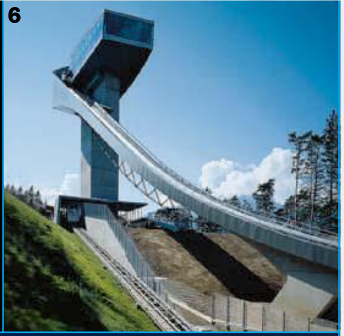

6

7

5. Shires Development (2007),
Foreign Office Architects,
with Adams Kara Taylor.
6. Innsbruck Ski Jump (2002),
Zaha Hadid,
with Jane Wernick for Arup.
7. BMW Event Center (2007),
Coop Himmelb(l)au,
with Bollinger & Grohmann.

Partners. Engineers Jörg Schlaich and Rudolph Bergermann, who later formed their own influential practice, were also part of the team. The project epitomizes Otto's ideas from his tensile structures of the 1960s, which used the principles of economy in large-span, lightweight membranes. This experimentation relied on Otto's position as the founder of the Lightweight Structures Institute at the University of Stuttgart, where he could use numerous modeling techniques—such as soap film structures, hanging chain models, and mechanical models—in which the radically simple processes resulted in form. At the institute, the baton was passed to Jörg Schlaich, who then taught Werner Sobek, the current director of the renamed Institute for Lightweight Structures and Conceptual Design. Otto's embrace of flexible and lightweight structures forms a contrast to monumental and weighty architecture.

Enabling collaborations

Today, shared Building Information Models (BIM), rather than just physical models, as with Otto's early projects, allow for feedback and integration between all the building professions, including that of the construction team. Adams Kara Taylor (AKT), a London-based structural and civil engineering firm of 40 people, will engage an architect's ideas for a project design, but, as engineer Hanif Kara says, they "do not pretend to be the architect." Key to the firm is teamwork and a constant dialogue with the architect. An in-house mathematics think tank with computational specialists assists teams, and it is common to see five engineers from five countries hunched over one computer as they jointly solve problems. AKT's nonhierarchical studio encourages creative thinking and innovation, but not at the cost of technical competence, achieving what Kara calls "great engineering rather than bad architecture." For its work on the Peckham Library in London (2000), with Alsop & Stormer Architects, the concrete-filled steel columns angle to support a cantilevered upper volume. Appearing like an upside down L-shaped volume, the building's structure freed Alsop from traditional constraints, opening the library's base to allow for public space. Kara, who worked for Anthony Hunt and also teaches at the Architectural Association in London, engineered Zaha Hadid's Phaeno Science Center in Germany (2005), where structural redundancy was eliminated so that the walls and concrete slab could combine as a continuous shell to achieve the fluid space the architect desired. Currently, Kara is collaborating on the design with Foreign Office Architects (FOA) of the John Lewis department store in Leicester, England (2007), that will also include retail and a cinema. AKT's proposed structural design enables FOA to foreground an intricate lacy glass facade by engineering large spans for an atrium, an auditorium, and loading dock areas, in addition to glass walkways through the atrium.

Before leaving to form her own firm, at Arup Jane Wernick engineered Hadid's curvilinear concrete Ski Jump in Bergisel in Innsbruck (2002) and the competition phase of Angelil/Graham/Pfenninger/Scholl's Portland Aerial Tram (see page 126) in Oregon. Taking into account what Peter Rice taught her when she was at Arup, to "let the architects in on their secrets," Wernick says she always explains her process at the outset of a project. Among her more notable achievements at Arup, her structural challenge for Marks Barfield Architects' London Eye ferris wheel (1999) was to design a 500-foot-high structure that moves, but would be stable and strong. Not surprisingly, she found the bicycle wheel, as a tensegrity structure, to be the most economical form. She resolved the structure with landside pylons supporting the wheel at the hub, with the spindle cantilevering out to allow the wheel to be suspended over the Thames River. Although unusual for historic London, the structural spectacle of the Eye has become

PHOTOGRAPHY (FROM 1–7): © HIROYASU SAKAGUCHI; IWAN BAAN; COURTESY SAANA; DOMINIQUE PERRAULT ARCHITECTURE; FOREIGN OFFICE ARCHITECTS; HELENE BINET; COOP HIMMELB(L)AU

one of the city's most exquisite examples of its engineering eminence.

Many times, the collaboration between architect and engineer results in buildings where intensified structural patterns emerge from a mathematical or nature-derived basis that is enabled by digital tools to become a kind of "deep decoration." Tristram Carfrae, of Arup's Melbourne office, employed the concept of bubble structures for the Watercube National Acquatics Center for the 2008 Beijing Olympics, designed with PTW Architects of Australia. The center's five pools are enclosed in a structure filled in with ETFE foil cushions—similar to those used at Grimshaw Architects' Eden Project in England (2001)—that both physically and literally represents a swimming pool. Rather than adopt Frei Otto's soap bubble investigations from the Munich stadium, Arup explored the connectivity of cellular arrays to combine the surface pattern with the internal structure of a ductile space frame that supports the long-span roof structure. The varied ETFE hexagonal elements resolve both the environmental and structural design in a nonlinear, unified form.

Material focus

Many engineers are interested in the structure of materials, as well as material-as-structure. The Modernist fascination with glass, in its duality of fragility and strength, in addition to its varying qualities of transparency and translucency, has played a notable part in many engineers' oeuvre. This can be found in the early work of Peter Rice's bracketed glass wall systems for the Grand Serres of the Science and Technology Museum in Paris's Parc de la Villette, with architects Adrien Fainsilber & Associés (1986), to structural glass systems of such contemporary practices as Dewhurst Macfarlane, Schlaich Bergermann und Partner, and Werner Sobek. In June, Rice's Paris-based firm, RFR, completed the structure for a 460-foot-long toroidal transparent volume to expand the Strasbourg TGV train station, designed by the architect Jean-Marie Duthilleul for the French National Railways. Relying on a slender prestressed-steel structure, the use of cold-formed curved and laminated glass minimizes its presence at the historic station. Working with Seele glass manufacturers, and incorporating solar gain analysis from Stuttgart-based climate engineers Transsolar, the project combines design, structure, and climate engineering in a truly holistic way while resulting in a bubble form at the station. Bollinger & Grohmann, working with Mutsuro Sasaki and Transsolar, devised a transparent sustainable office building in a Minimalist structure for SANAA's Novartis project in Basel, Switzerland (2007). The extremely thin reinforced-concrete floor slabs supported by structural walls achieved the desired open floor spans, as well as transparency through the rectilinear building. With design assistance from the New York–based facade consultants Front, the translucent building appears as a thinly veiled glass box.

New York–based engineer Guy Nordenson, working with Los Angeles architect Michael Maltzan, designed the Ministructure No. 16 in Jinhua City, China, a 1,300-square-foot pavilion in a historic garden. Beginning the design with a concrete structure, the team switched to steel because of the high water table. A hybrid Veirendeel steel structure, accompanied by smaller ladder trusses, resulted in a double-perforated facade that creates an unexpected moiré pattern on the building's skin.

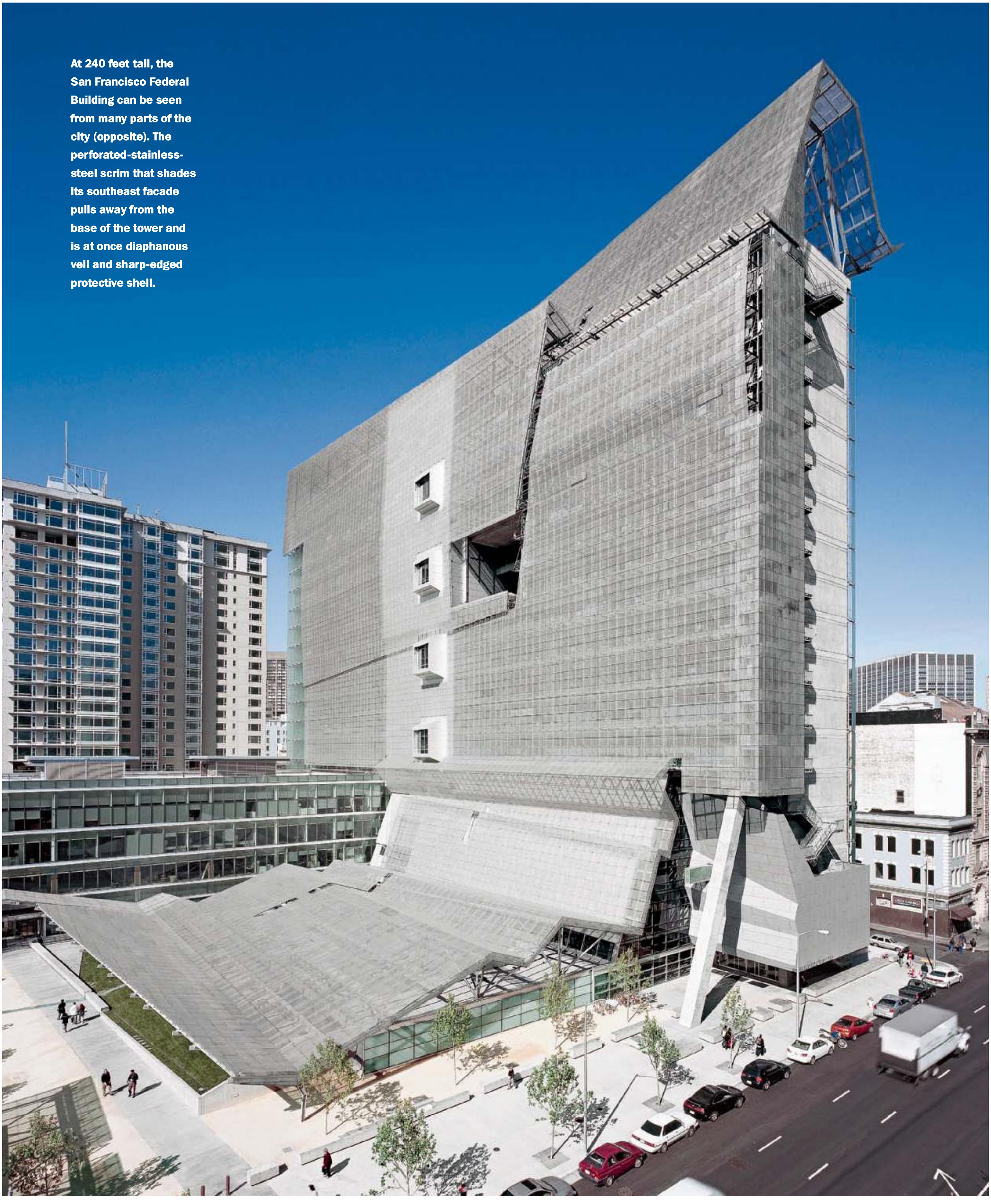
Algorithms and patterns of structure

Structural engineers have been doing analysis in 3D for decades, but now they share those models with architects as digital versions of construction drawings. These models now increasingly rely on complex computer-code-based geometrical relationships that require engineers to be as much programmers as designers. Much of this work has resulted from firms designing their own software, such as Happold's Tensyl for tensile structures or Bollinger & Grohmann's program for trusses, though Autodesk's Revit and Bentley's Generative Components have revolutionized design for many engineers.

Algorithmic design processes resulted in the structural maneuvers of Bollinger & Grohmann's proposed tessilations for Dominique Perrault's Mariinsky Theatre II in St. Petersburg, Russia (2008). The Mariinsky's structure is defined by a system of connected steel pyramids, like an asymmetric geodesic dome, filled in with cross ribs that radiate out to support a metal-mesh infill. The shell wrapping the theaters appears like a geode, where structure and skin are combined into one system, similar in theory to the deep decoration found on Arup's Watercube. Cecil Balmond, one of Arup's directors, works experimentally with algorithms with architects such as Rem Koolhaas, Daniel Libeskind, and Toyo Ito. Balmond has written a book, *Informal* (2002), and his projects are currently on view in *The Frontiers of Architecture I* exhibition at the Louisiana Museum of Contemporary Art, in Denmark, through October. The 2002 Serpentine Pavilion in London expresses many of his concepts most explicitly. Designed with Toyo Ito, the structure was based on twisted squares arranged in circular patterns, connected with their primary lines of force. The overall patterning of the shell, in crossing lines and planes, makes the skin and structure one—more similar in concept to a traditional load-bearing wall than to systems of separate structure and infill. The pavilion is a physical manifestation of an algorithm: Pattern and structure are integrated and become a form. As Balmond says, "The design started with a simple line that was repeated, releasing architecture from structure, rather than trapping architecture through the structure." Diagonally gridded exterior-structural-skin systems have also become emblematic of his use of structure as pattern, as is the case for the diagrid structural skin of OMA's CCTV Tower, under construction in Beijing.

Nonlinear shaping of structure is dominant in Mutsuro Sasaki's work in strong collaborations with Toyo Ito and Arata Isozaki, as he believes there is a creative process involved in developing hypotheses regarding a structure's shape, system, materials, and dimensions. Focusing on form-finding and shape design in curvilinear and organic forms, Sasaki bases designs on principles of self-organization in nature. Using his 3D Extended Evolutionary Structure Optimization (ESO) method, he defines his forms within a collaborative digital model to result in optimized and rational structures. For Ito's Crematorium, in Kakamigahara Gifu, Japan (2006), the curvilinear reinforced-concrete roof shell, only 7.8 inches thick, was evaluated using Sensitivity Analysis, a systematized method for analyzing curved surfaces to determine an efficient structural shape. As he describes in his 2006 book, *Flux Structure*, "By means of the repetitive nonlinear analysis procedure it becomes possible to organically comprehend the evolution of structural form in the overall structure from the relationships between its shape and mechanical behavior."

These perspectives in turn shape the future of complex space, as well as suggest the realization of new paradigms for collaboration between design, structure, and environment. The full integration of structural engineering into the process of architecture does not guarantee good architecture or revolutionary space and forms, but enables their potential to exist. Now more than ever, engineers are embracing the natural world and poetically exploiting its logic to realize architecture's possibilities. As Ove Arup said in his "Key Speech," the aims of his firm are not "grasped arbitrarily out of the sky or willfully imposed, they are natural and obvious." ■



At 240 feet tall, the San Francisco Federal Building can be seen from many parts of the city (opposite). The perforated-stainless-steel scrim that shades its southeast facade pulls away from the base of the tower and is at once diaphanous veil and sharp-edged protective shell.

Morphosis and Arup engineers create dynamic form that follows function for the U.S. FEDERAL BUILDING in San Francisco

By Joann Gonchar, AIA

The southeast facade of the U.S. Federal Building in San Francisco is covered with a perforated-stainless-steel scrim that seems at once to be a diaphanous veil and a sharp-edged protective shell. And the dual nature of this 18-story office tower seems just right for its rapidly changing but still gritty environs, where pawn shops sit cheek by jowl with luxury condos. Completed in March, the 240-foot-tall tower dominates the mostly low-rise South of Market skyline and is reportedly snarling traffic on nearby Interstate 80 as drivers slow down to take a look. But its height and gutsy exterior are not the only reasons the Federal Building is getting attention. It also has a set of ambitious environmental goals.

The designers and the owner, the General Services Administration (GSA), say that the tower, which relies on natural ventilation to cool its upper 13 floors, will consume 33 percent less power than an office building designed to comply with California's stringent energy code, Title 24. The majority of the work spaces are largely illuminated by daylight, a strategy that is expected to reduce energy use associated with lighting by about 26 percent over a standard office building. In addition, replacement of half of the portland cement in the exposed-reinforced-concrete structure with blast furnace slag—a by-product of steelmaking—prevented release of approximately 5,000 tons of carbon dioxide into the atmosphere.

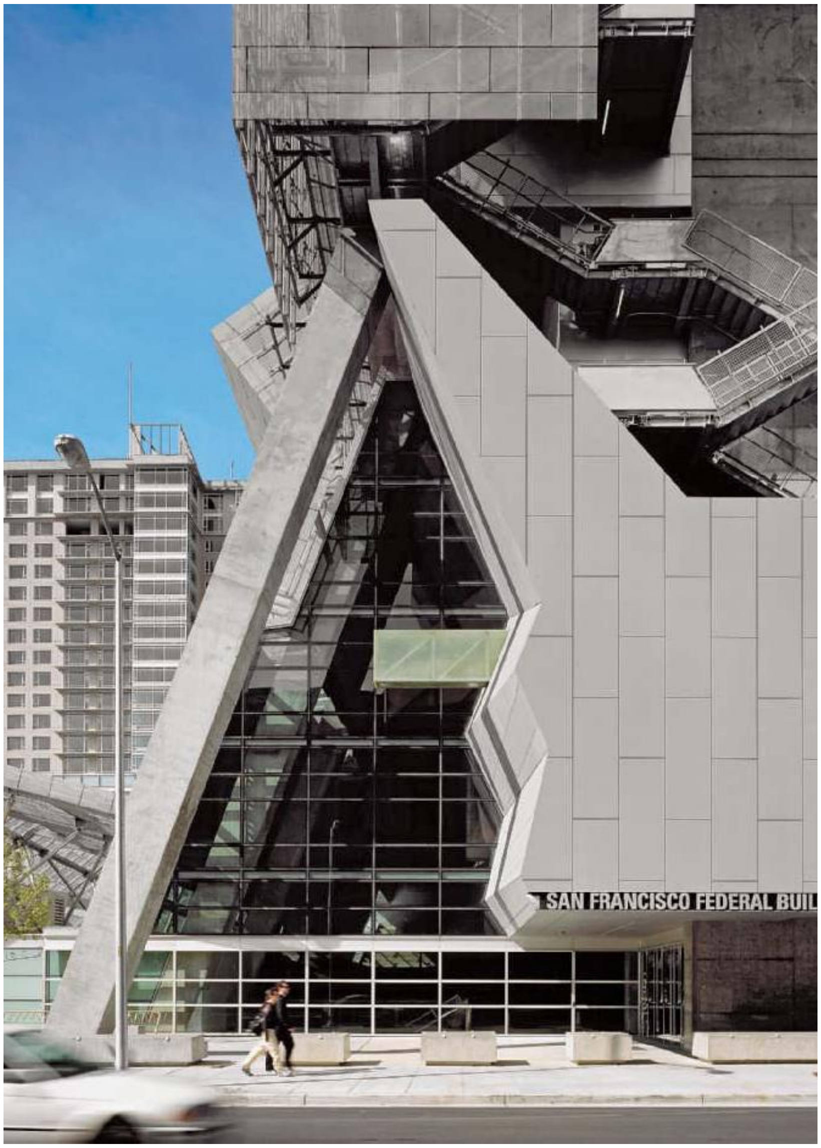
The tower is the product of a highly collaborative design process, and its form, structure, and orientation are fully integrated to achieve these efficiency targets. "The building is defined by performance," says Thom Mayne, FAIA, principal of Morphosis, the project's lead design architect. Of course, there are elements of the building that are more about expression than function, such as its roof, where the stainless-steel scrim angles up and folds over like a rakish cap. "At the top, the scrim is pure form," says Mayne. "It's a balance of poetry and pragmatics."

Mayne's "pragmatic" concerns are not limited to energy and resource conservation. The tower is the centerpiece of a 605,000-square-foot, $144 million, Morphosis-designed complex, which has a significant urban and civic agenda. In addition to the tower, it has a four-story barlike office annex, a freestanding café, and a day-care center. These facilities, all mechanically ventilated and steel framed, define a plaza at the corner of Seventh and Mission Streets. This plaza is much more than an empty outdoor space offered as compensation for the tower's height. It provides breathing room for the Beaux-Arts James R. Browning U.S. Courthouse across the street. It also eases public access to features of the program, such as the café, which might otherwise have been buried within the tower. Although the day-care center is accessed through the tower lobby, enrollment is nevertheless open to neighborhood children. The architect has given this facility a strong plaza presence with the shading scrim—which pulls away from the tower near its base—unfolding to shelter the semi-submerged building like an irregularly crimped accordion.

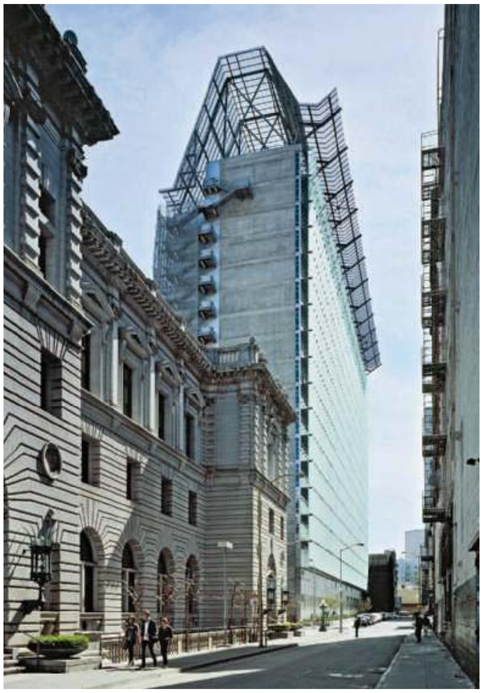
Similarly, the tower's three-story-tall sky garden, which provides spectacular views of the city and San Francisco Bay, is open to the public. It is expressed as a huge void in the southeast facade, visible even at night, when it is illuminated by a neon installation by James Turrell. "These moves are intended to break down the distance between the community and the federal government," explains Tim Christ, Morphosis project manager.

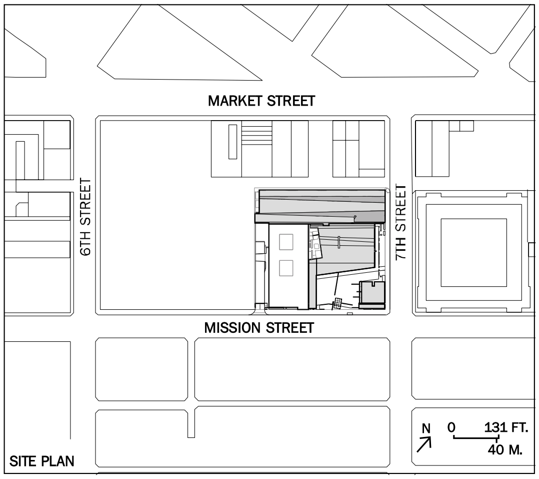
Project: *United States Federal Building, San Francisco*
Lead design architect: *Morphosis—Thom Mayne, FAIA, principal; Tim Christ, project manager; Brandon Welling, project architect*
Executive architect: *SmithGroup—Carl Roehling, FAIA, project executive; Carl Christiansen, AIA, principal in charge; William Loftis, AIA, project manager; Jon Gherga, project architect*
Consultants: *Arup (structural, m/e/p); Horton Lees Brogden (lighting)*
General contractor: *Dick Corporation/Morganti Group*

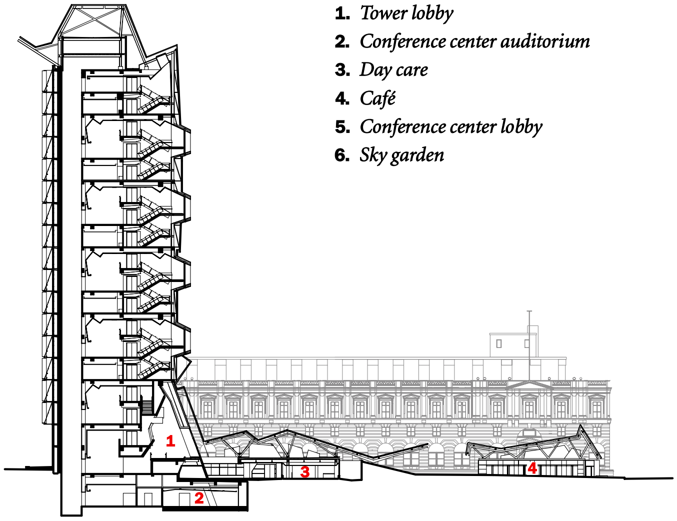
PHOTOGRAPHY: © ROLAND HALBE, EXCEPT AS NOTED; © TIM GRIFFITH (THIS PAGE)


SAN FRANCISCO FEDERAL BUIL

In addition to the tower, a four-story barlike office annex, a free-standing café, and a semisubmerged day-care center define the Federal Building's plaza (opposite) and provide breathing room for a turn-of-the-last-century courthouse across the street. In a gesture that the architect refers to as "pure form," the stainless-steel scrim that shades the southeast facade folds over the roof like a rakish cap (below). The tower's entrance is marked by its emphatic structure instead of a set of grand stairs or other monumental features often associated with government buildings.



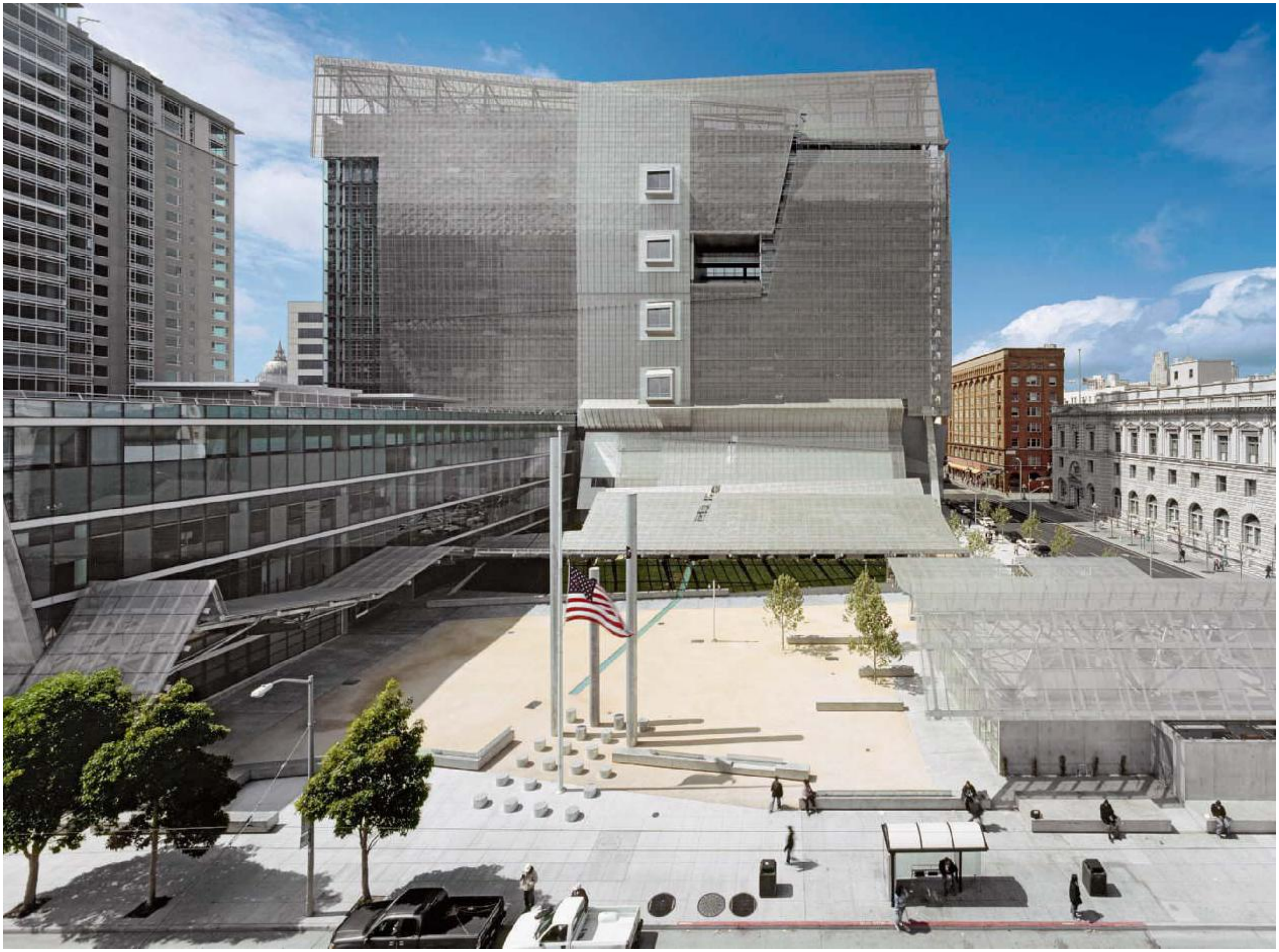

MARKET STREET
6TH STREET
7TH STREET
MISSION STREET
N
0
131 FT.
40 M.
SITE PLAN

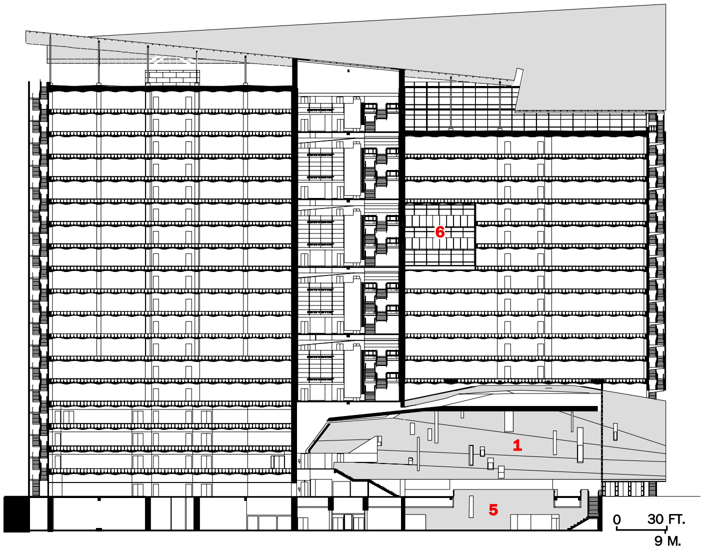


1. *Tower lobby*
2. *Conference center auditorium*
3. *Day care*
4. *Café*
5. *Conference center lobby*
6. *Sky garden*

0 30 FT.
9 M.

TOWER CROSS SECTION THROUGH ELEVATOR LOBBIES

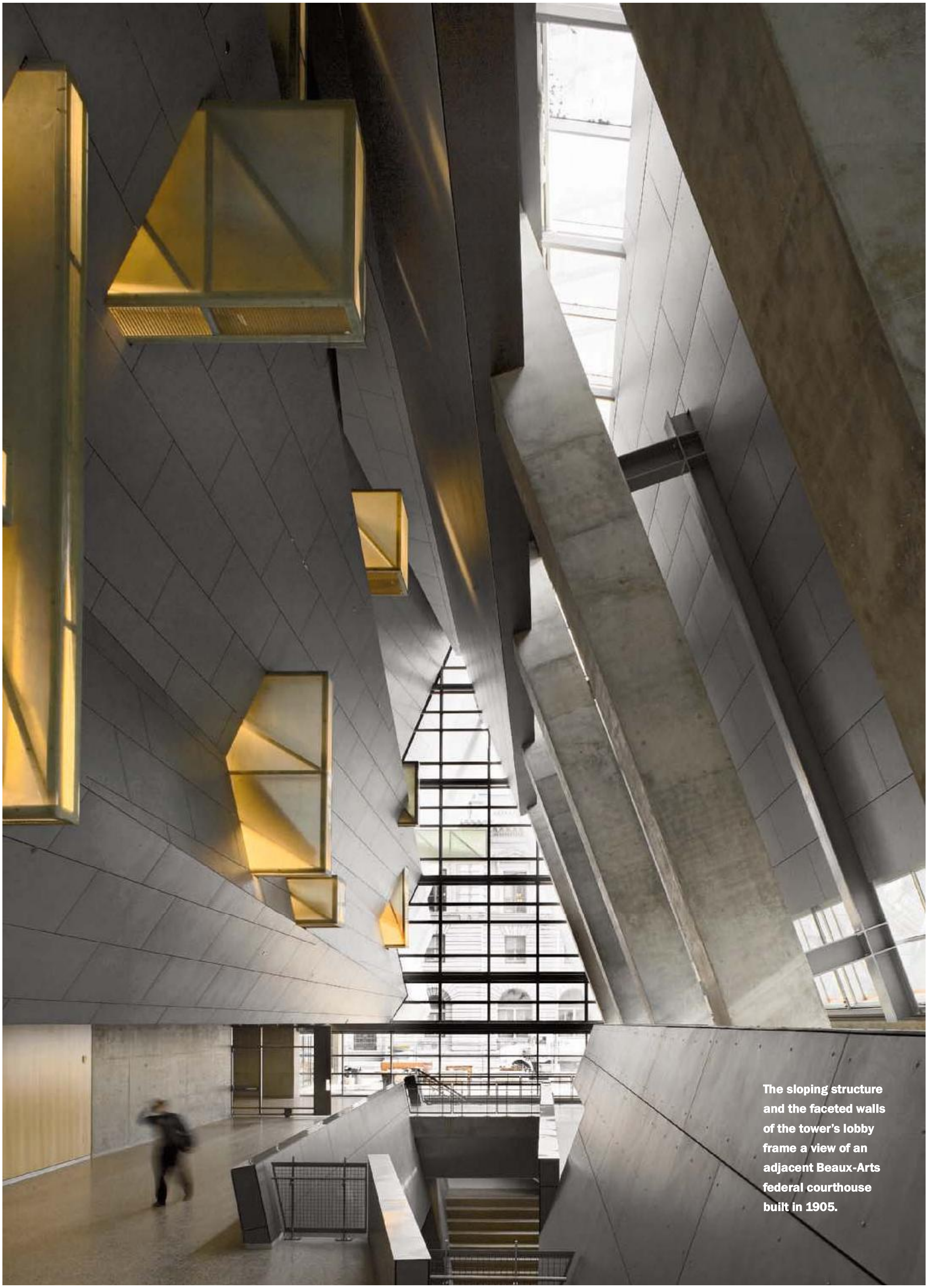




TOWER LONGITUDINAL SECTION THROUGH ELEVATOR LOBBIES

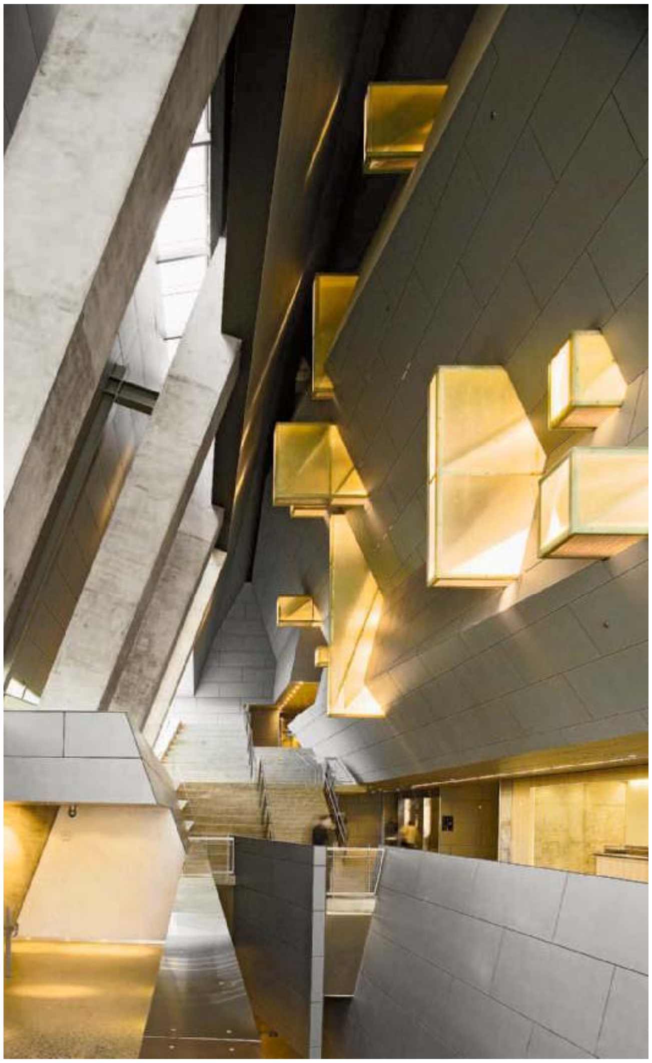
Other spaces within the building offer opportunities for lingering and chance meetings. For example, the 90-foot-tall ground floor lobby is more than a place to scurry through to reach the elevator. Here, stairs transform into informal seating, and daylight from above washes over polished concrete floors and faceted walls of reinforced-fiber-cement panels. The environment is one that Mayne describes as "raw simplicity" without being austere. On the upper floors, the three-story lobbies that are a by-product of the skip-stop elevator system, were also conceived as social spaces. They are adorned with murals by Ed Ruscha and include inviting stairs with landings that project from the facade and provide views of the city.

Many of the social and urban redevelopment goals were a component of the program since even before Congress approved funding for the project in 1989. However, the energy conservation goals did not emerge until about a decade later, when Mayne was selected as part of the GSA's Design Excellence Program. The owner organized a meeting with representatives of the 1,500 federal employees from the six tenant agencies to better understand their requirements. What emerged was a desire for work spaces with access to daylight and views and for features such as operable windows that would offer occupants individual control over their environments, says Maria Ciprazo, AIA, GSA project executive.



The sloping structure and the faceted walls of the tower's lobby frame a view of an adjacent Beaux-Arts federal courthouse built in 1905.

From the entry (below), with its angular maple-veneer walls and ceilings, visitors and tenants enter the lobby where daylight from above is supplemented by light from projecting lanterns (right).



PHOTOGRAPHY: © NIC LEHOUX

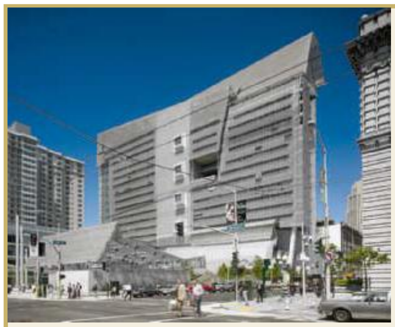
Although several years in advance of the GSA's adoption of a requirement for LEED certification, architect and client realized that the occupants' vision for the building was compatible with one that would be energy- and resource-efficient, especially if they could take advantage of San Francisco's benign climate to render air-conditioning unnecessary. "We wanted to push the building as far as possible, but we did not want to spend public funds cavalierly," says Ciprazo. So to test the feasibility of a naturally ventilated office tower, the GSA turned to scientists from Lawrence Berkeley National Laboratory to undertake weather-data analysis, wind-speed studies, and airflow modeling.

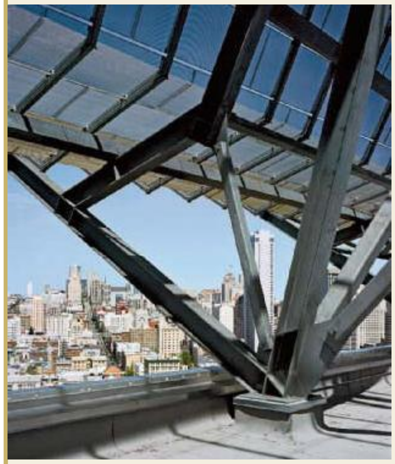
The building that evolved from this research and from early and intense collaboration with mechanical and structural engineers, lighting designers, and other consultants, was a tall and narrow structure with a 340-foot-long, and only 65-foot-wide, floor plate—slender enough to allow access to daylight and views from almost all of the work spaces. The typical floor is organized with workstations at the perimeter and meeting rooms and private offices along the spine. These glass-enclosed "cabins" are mechanically cooled, as required by code. However, their roofs are pulled away from the undersurface of the slab, so as not to obstruct the flow of air as breezes enter through openings on the tower's windward elevation and are vented through the opposite facade. The city's zoning regulations restrict the height of buildings to 120 feet in the Market Street corridor, to the northwest, ensuring that this flow of air will remain unobstructed.

The openings in the two long facades, some of which the individual occupants control, and some of which the building automation system (BAS) controls, include operable windows as well as trickle vents located near the floor. The vents let in small quantities of fresh air warmed during chilly weather by a fin-tube convector located directly above them.

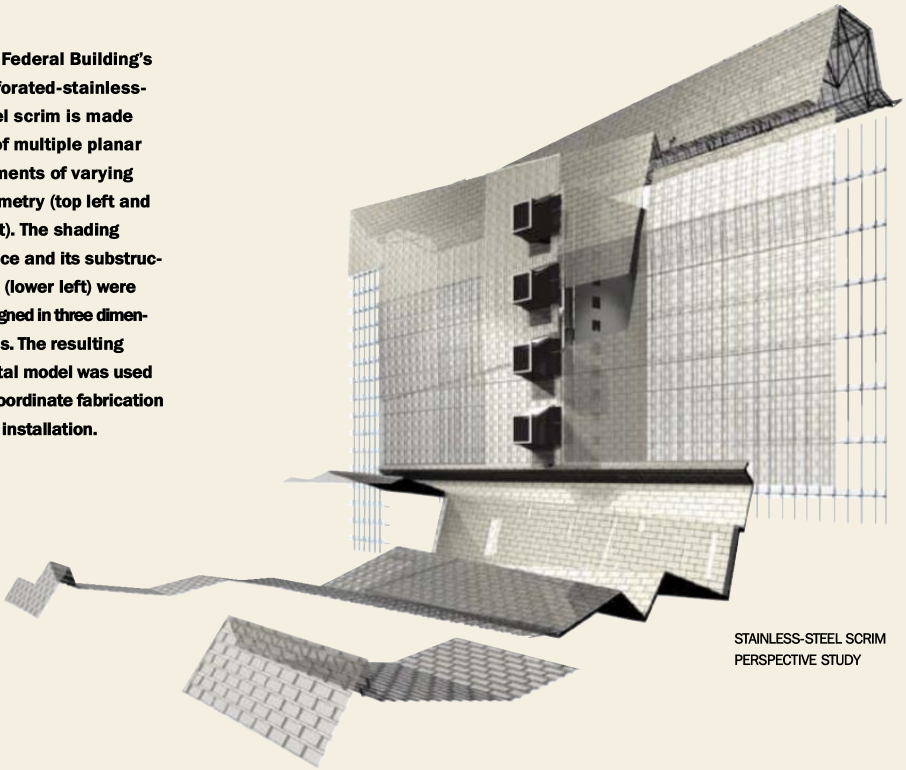
To protect the facades from excessive solar heat gain, the designers clad them in high-performance window wall. On the southeast, the perforated-stainless-steel scrim, the building's chief expressive element, does double duty as a shading device. On the northwest facade, frosted-glass fins break the sun's path and provide protection from glare.

The Federal Building's exposed-concrete structure and the thermal mass it provides are critical components of the cooling strategy. At night, when warm weather is expected the next day, the building's structure is "charged" for about 8 to 10 hours, explains Erin McConahey, Arup associate principal and project mechanical engineer. The BAS opens the facades' operable apertures and then closes them once the concrete has cooled sufficiently. Then, during the day, heat generated by occupants,

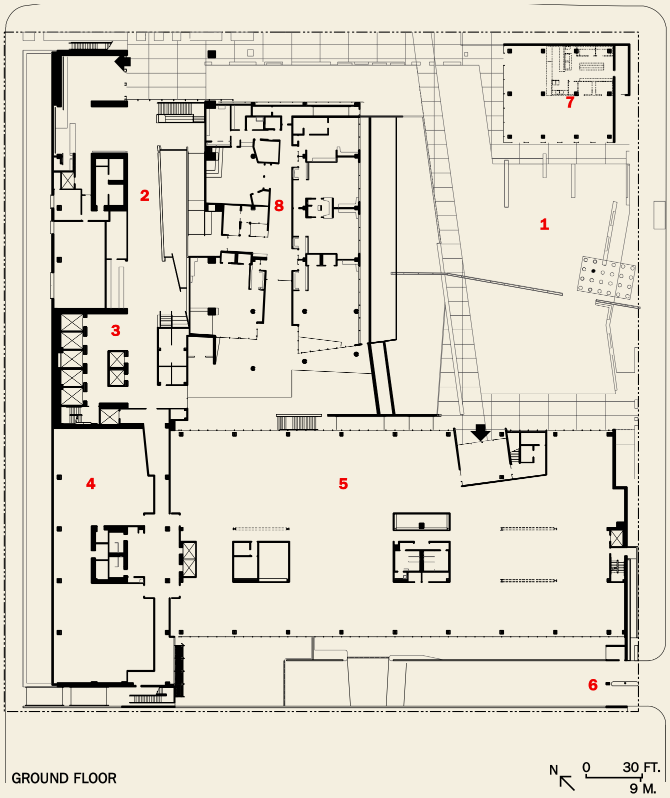




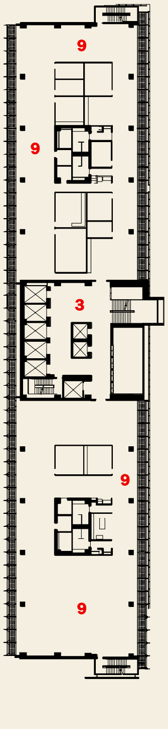
The Federal Building's perforated-stainless-steel scrim is made up of multiple planar elements of varying geometry (top left and right). The shading device and its substructure (lower left) were designed in three dimensions. The resulting digital model was used to coordinate fabrication and installation.



STAINLESS-STEEL SCRIM
PERSPECTIVE STUDY



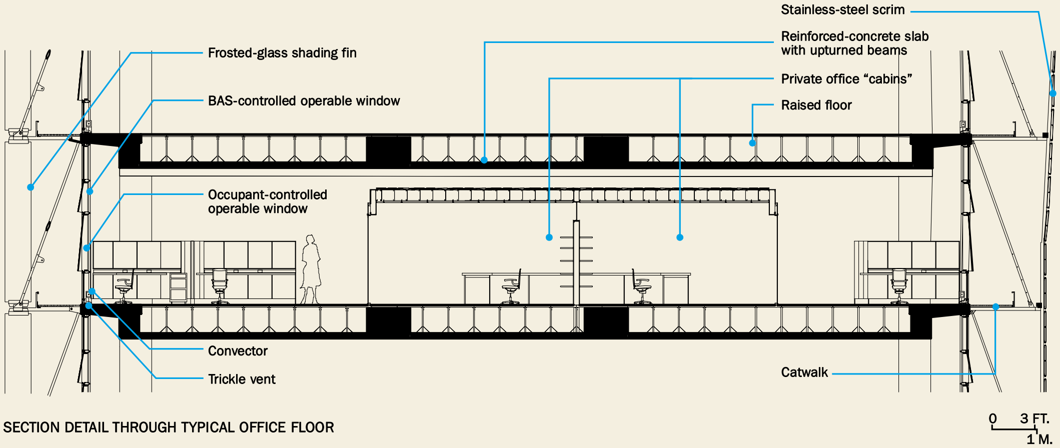
GROUND FLOOR



TOWER PLAN-LEVEL NINE

1. *Plaza*
2. *Tower lobby*
3. *Elevator lobby*
4. *Storage and m/e/p*
5. *Annex*
6. *Parking/loading access*
7. *Café*
8. *Day care*
9. *Office space*

The designers protected the tower's facades from heat gain with a shading scrim on the southeast elevation and frosted-glass fins on the northwest. Some of the openings in these window walls are controlled by the occupants and some by the building automation system.

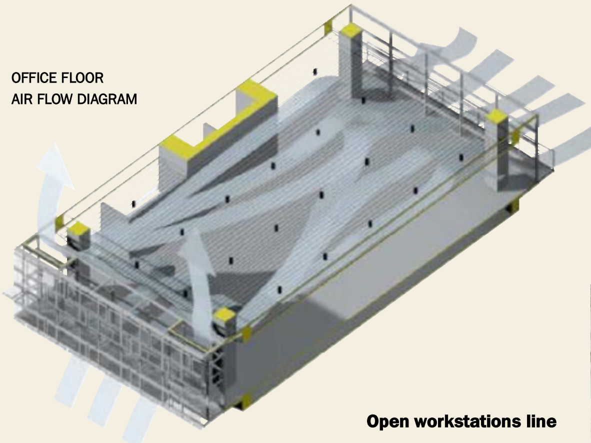

Stainless-steel scrim
Reinforced-concrete slab with upturned beams
Frosted-glass shading fin
Private office "cabins"
BAS-controlled operable window
Raised floor
Occupant-controlled operable window
Convector
Trickle vent
Catwalk
0 3 FT.
1 M.

SECTION DETAIL THROUGH TYPICAL OFFICE FLOOR

A tower shaped by performance objectives and design process

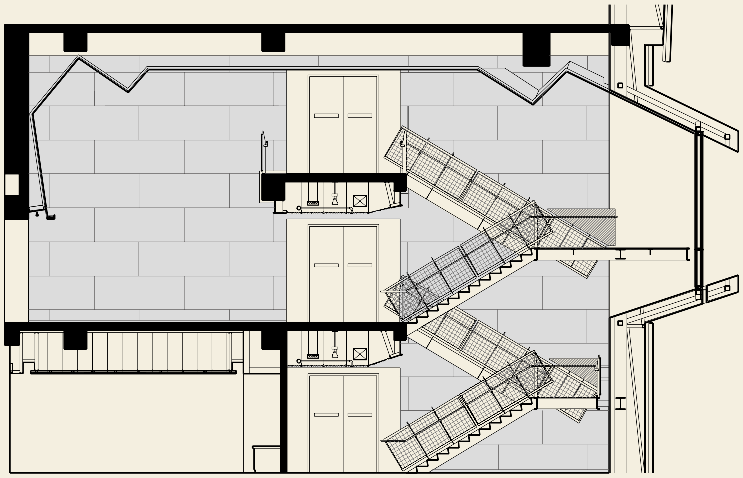
The form, structure, and orientation of the Federal Building office tower are the product of weather-data analysis, wind-speed studies, and air-flow modeling, and an integrated design process. Office floors are long and narrow to provide views and promote daylighting. The slender floor plate permits breezes to enter through openings on the tower's windward elevation and allows venting through the opposite facade. The building's exposed-concrete slabs are supported by an upturned beam system and have a wave profile in section. The configuration maximizes structural efficiency while increasing surface area, enhancing the slab's ability to absorb heat generated by people, computers, and lights.

OFFICE FLOOR
AIR FLOW DIAGRAM



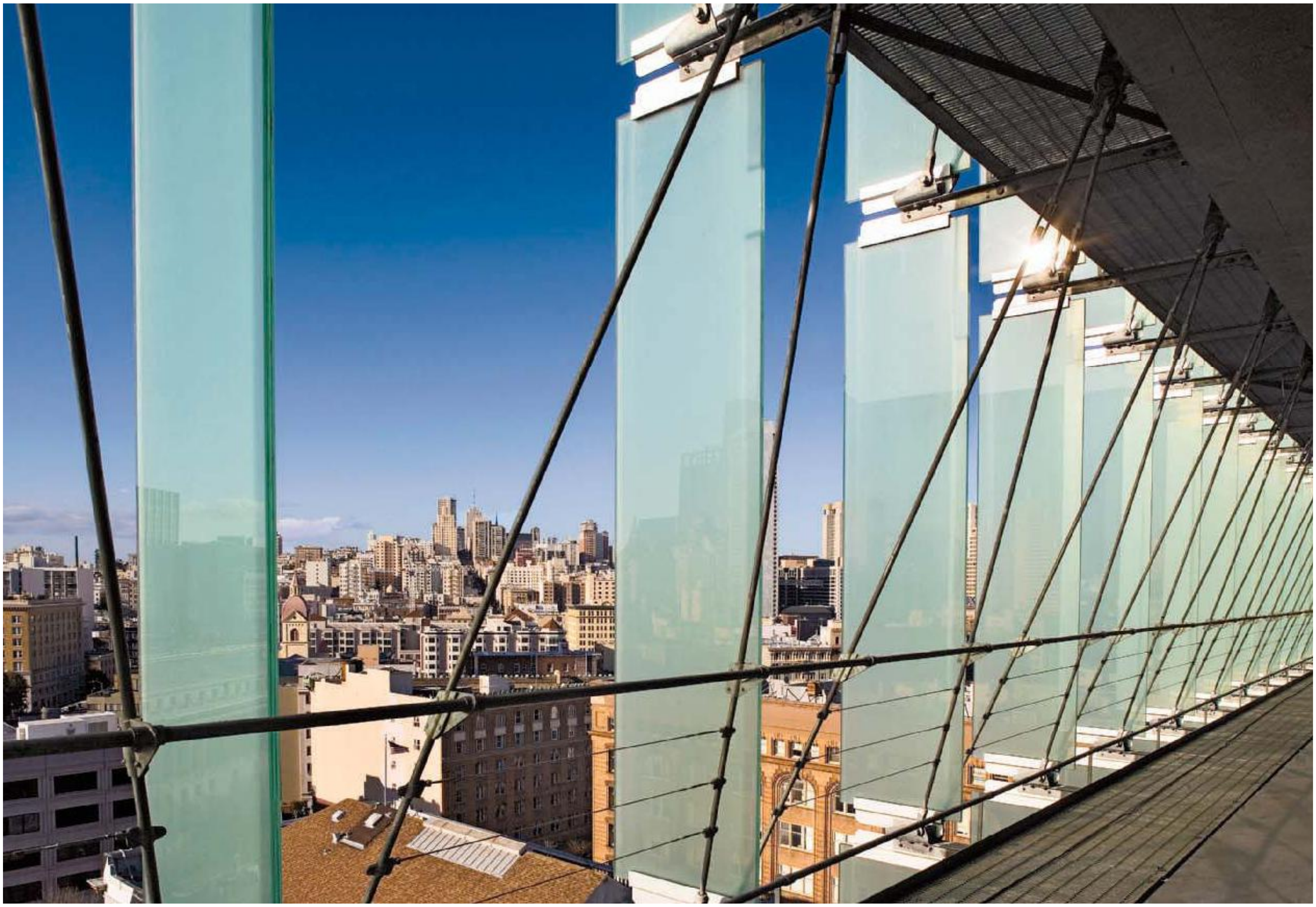
Open workstations line the perimeter of the office floors while glass-enclosed meeting rooms and office "cabins" occupy the building's spine (right).

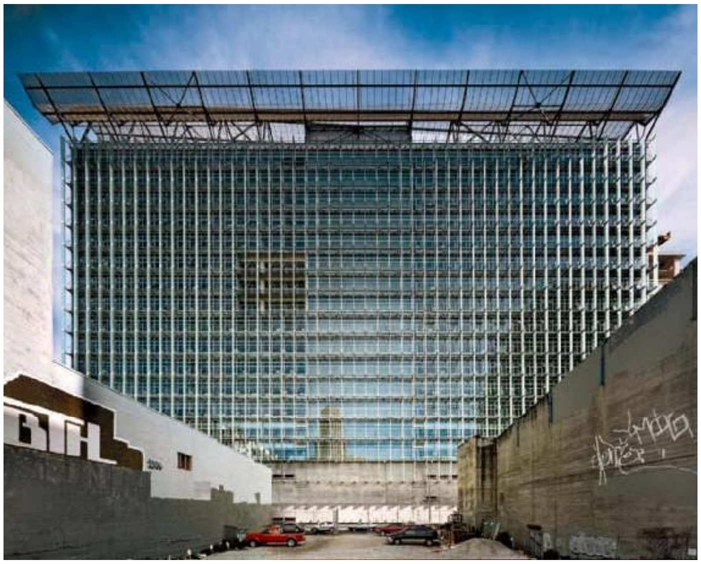
Three-story lobbies (right) are a by-product of the skip-stop elevator system first pioneered by Le Corbusier. Projecting stair landings afford views of the city (opposite, bottom).



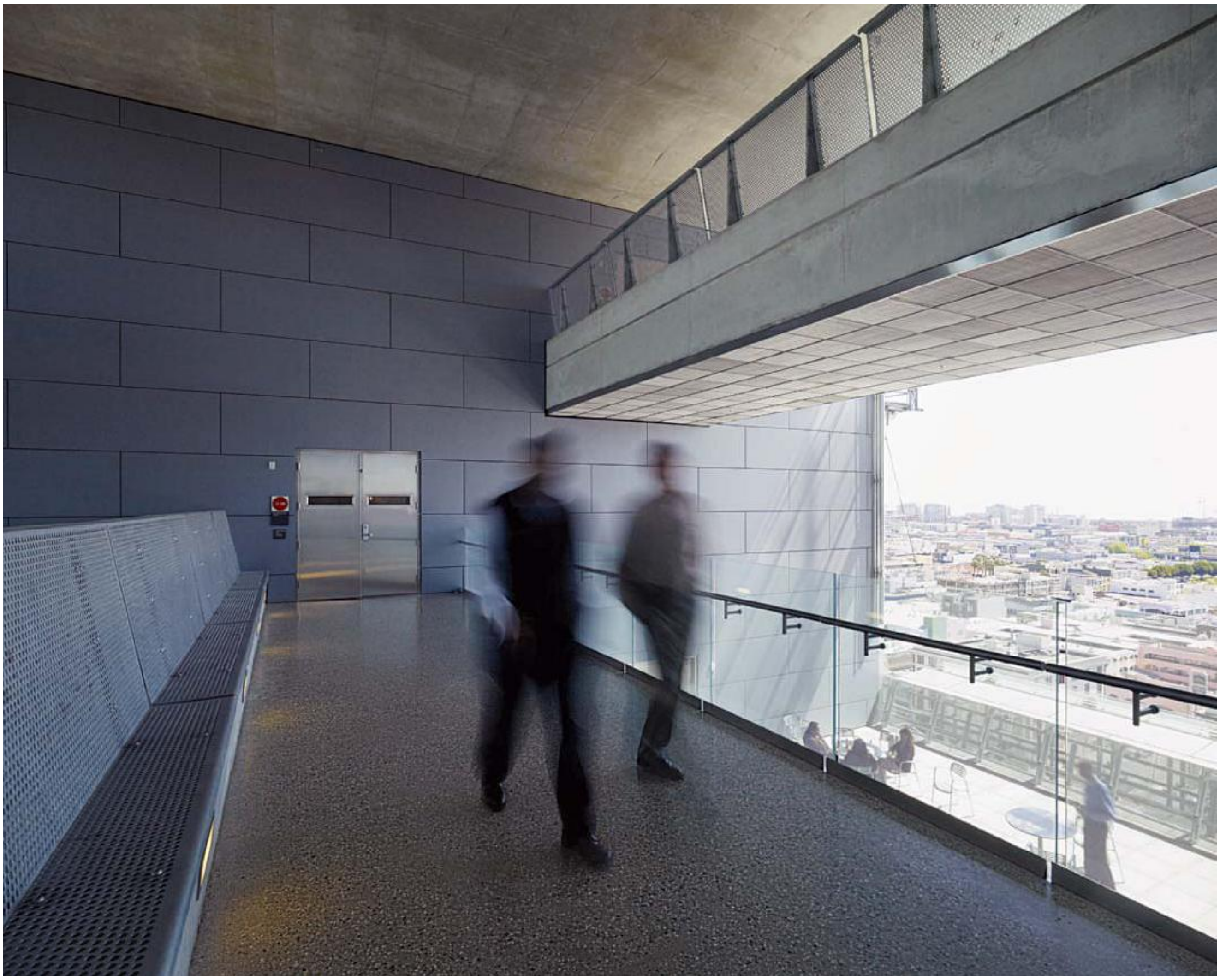
SECTION THROUGH TYPICAL ELEVATOR LOBBY

PHOTOGRAPHY: © TIM GRIFFITH (OPPOSITE, TOP LEFT); NIC LEHOUX (OPPOSITE, BOTTOM RIGHT)





The frosted-glass fins on the northwest elevation (this page) are separated from the window wall with a catwalk. Zoning regulations limit the height of adjacent buildings to 120 feet, ensuring that the flow of air through this facade will not be obstructed. The sky garden's suspended walkways (opposite) have fritted-glass balustrades and incorporate seating.



computers, and lights, is transferred to the slab by radiation.

The architects and engineers collaborated to find the slab configuration that would promote the lamination of air and provide maximum cooling. In most towers, floor slabs typically sit on top of perimeter beams. But such an arrangement would have blocked air flow, impeded penetration of daylight, and obstructed views. As an alternative, the design team took advantage of the client's desire for a raised floor and devised an upturned beam system. The slab suspended from these beams is ribbed with a wave profile in section, creating an efficient structure that weighs less than a conventional slab. It also provides additional concrete surface area, enhancing the slab's ability to absorb heat. In this element, the requirements of "thermal mass, architecture, structure, and daylighting all came together," says Steve Ratchye, who was Arup project structural engineer and now is an associate in the Los Angeles office Thornton Tomasetti.

Most tenants are reportedly pleased with the daylight and views, but some complain that the building is too warm after several hot days in succession. McConahey confirms that this will be the case, especially if occupants open windows too early on a hot morning, prematurely causing the structure to lose its ability to cool, due to exposure to warm air. To help tenants better understand their role in maintaining a comfortable work environment, the owner is preparing an operations manual geared to individual occupants, according to Ciprazo. It is also installing shades at some locations in response to complaints about a lack of visual privacy in private offices and glare on computer screens under certain daylighting conditions.

The GSA is gathering less anecdotal information through an extensive postoccupancy evaluation. Over the next 18 months, researchers will evaluate energy consumption, lighting levels, acoustics, temperature, and air quality, as well as more subjective factors, such as employee satisfaction. Project participants are confident that the building will perform as predicted once it is fully commissioned and the tenants become familiar with their role in its operations. Even so, they do not foresee a proliferation of naturally ventilated office towers across the U.S., since there are few other places with the right climate conditions. Instead, they say, the lesson of the Federal Building is about achieving sustainability through a deep understanding of site and location. According to McConahey, "appropriate engineering solutions arise out of groundedness." ■

PHOTOGRAPHY: © NIC LEHOUX (OPPOSITE THREE); © TIM GRIFFITH (THIS PAGE)

For sources, see page 132.

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CRITICISM: One person at a time

Sylvia Lavin, *a professor and the former chair at the University of California at Los Angeles's Department of Architecture and Urban Design, has written extensively on architecture and the work of Thom Mayne and Morphosis, including a contribution to the 2006 book* Fresh Morphosis. *Her tenure as chair at UCLA included working with Mayne, also a professor in the department. In this essay, she considers the San Francisco Federal Building in terms of a global war on terrorism, where governments matter less than individual terrorists operating across borders. For Lavin, architecture must change to meet these terms, for the architect's place is no longer to criticize institutions in order to effect utopian change, but to reach the individual people within those institutions, which offers the best hope for improving the world.*

What does it mean for a Pritzker Prize–winning architect to build for the federal government as it wages a war of choice? In the past, I would have said this was an unreasonable question to ask an architect. I would have explained that we ask such questions because it's easier to blame homelessness, for example, on architects because they design houses rather than on the social and economic systems that structure housing. Architects have extra social obligations because they are educated and belong to the professional classes, but not because they are architects.

I would have invoked the notion that architecture is a relatively autonomous discipline. Just as lawyering is not "the law," architecture is not reducible to the sociology of building use, and its structures not synonymous with the institutions they house. I would, in other words, have set up a perimeter protecting the autonomy of architecture as a discipline—with its own internal rules and language—from the messiness of building as a professional and material practice. Furthermore, I would have felt it was my social obligation to keep architecture free from such contaminations, able to pursue issues not dictated by the pursuit of political or economic advantage.

But that was in the past. Today, suicide bombers in public places and elective warfare have collapsed the distinction between the civilian and the military realms, between blameless bystanders and legitimate targets. And because the logic that maintained these oppositions—between personal innocence and institutional responsibility—is the same logic that separated architecture as a discipline from building as a profession, architectural autonomy must now be added to the list of the casualties of war.

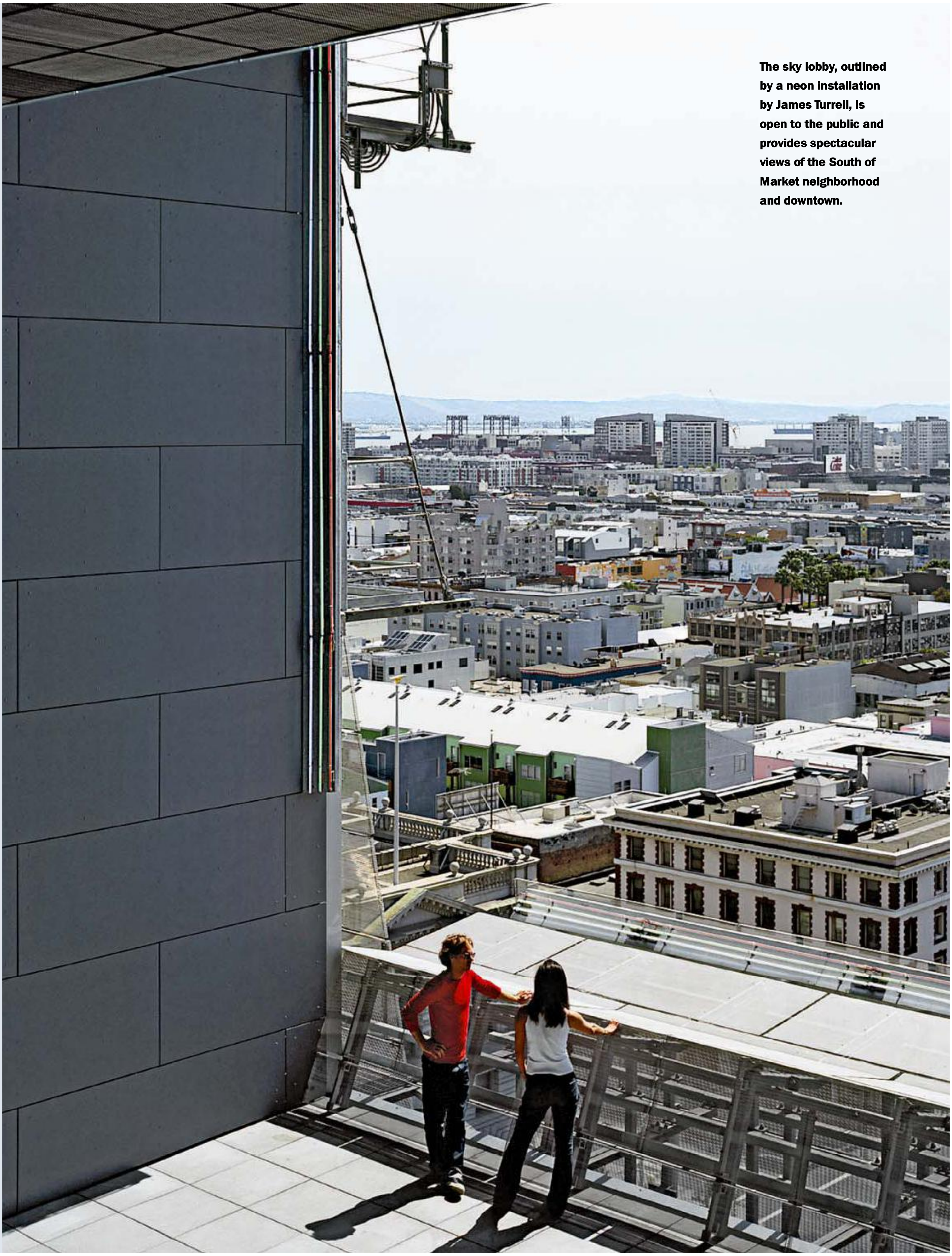
Morphosis's Federal Building is both a good and a bad excuse to consider the impact for architecture of losing its autonomy. Bad, because it is always onerous to use a single example to examine a general condition. And worse, because while Thom Mayne has fought to strengthen the cause of architectural self-determination against the forces that make architecture a weak service provider, he has simultaneously fought to engage the political process, deliberately seeking work outside the cultural sphere and within the milieu determined by restrictive public agencies.

But these reasons also make the Federal Building a potent demonstration of why these questions need asking now. First, the utter mediocrity of most public and especially federal buildings of the past few decades has kept them out of the public eye. The General Services Administration's Design Excellence Program has increased expectations, and Mayne is now its best-known poster boy. Second, Mayne describes his project as a unique combination of avant-garde formal autonomy and political engagement. He claims the capital he gains as a form giver makes him more effective in the social world and that he has thus become a new kind of critical architect who works with and through institutions rather than simply against them. Finally, the Federal Building is situated within the increasing misalignment of a series of once-coherent American beliefs: It is not a traditional civic monument, but an office building doubling as a representation of a federal government led by men in Washington, D.C., who like to eat McDonald's food and pretzels in a city known for high cuisine and progressive social policy but retrograde politics and conservative architecture.

This desynchronization of beliefs and institutions previously understood as intrinsically consistent may injure architectural autonomy but may also be a productive impetus for its reconsideration. A common refrain of contemporary warfare is that battle is waged against regimes not individuals—the U.S. didn't like Saddam Hussein as head of state, but Americans love the Iraqi people. This is the same model that organized the avant-garde who fought against the bourgeoisie as a social category but relied on the progressive patronage of its individual members. Historically, then, critical architects, like military generals, target institutions, not people. But increasingly, institutions that once had to be pushed to embrace modern secularism are now more progressive than the often deeply religious, culturally fixed, and socially conservative individuals running them.

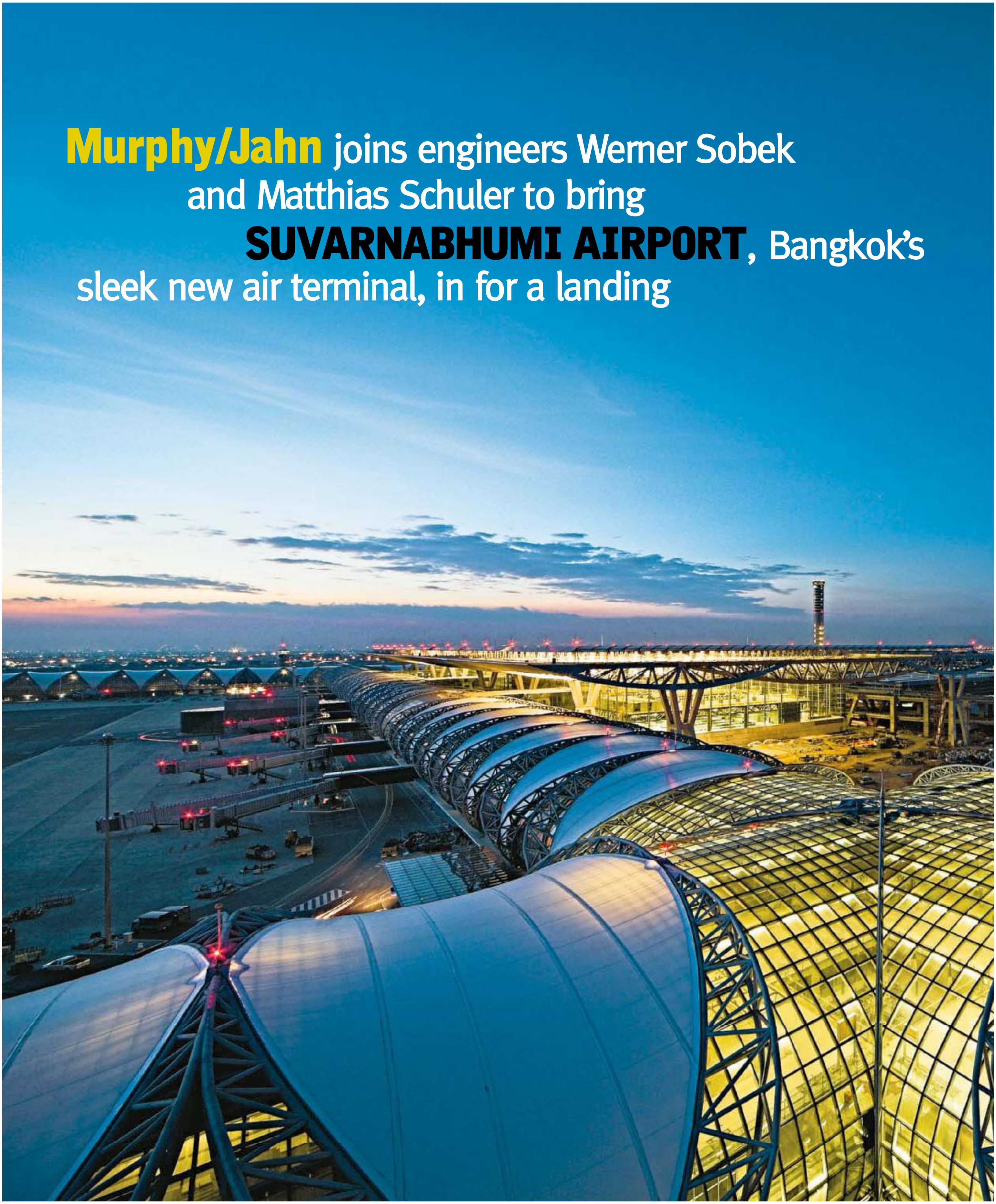
The Morphosis design does not question the authority of the federal government or undermine its will to appear to occupy a moral high ground: Indeed, I suspect the design will make most federal employees feel virtuous about going green and grateful for the fresh air and great views. But since the most direct means of effecting change is no longer the government as such but the people who vote (or don't vote) for our elected officials, it is now necessary to ask, "Just who will be going to work in the Federal Building every day?" Certainly not the resistant proletariat for whom the Russians designed housing in the 1920s and Le Corbusier the Unité, the organizational models adapted by Morphosis for this office building. Instead, the employees here, necessarily U.S. citizens, can at best feign indifference to the government's international policies. For an architect with Thom Mayne's political persuasions, manifested precisely in his choice of architectural precedents, these "but-I-just-work-here" users are more combatants than allies.

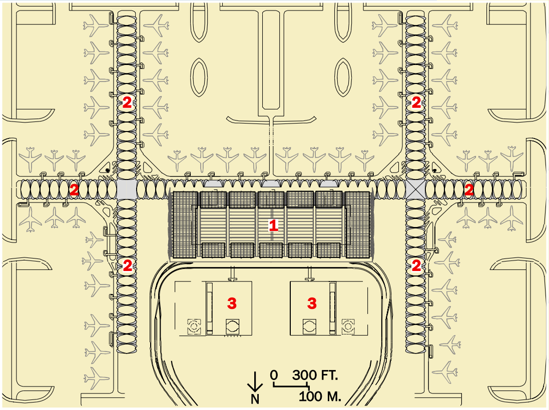
Once it becomes permissible to see the user as a potential soft target (an undoubtedly sacrilegious observation, since architects always overidealize the user), it also becomes conceivable that architecture may lose the war on autonomy but win the battle to effect change. So maybe the big battles are the micro-events that will inevitably occur in the Federal Building's skip-stop elevators, indoor landscapes, and outdoor living room: all these misaligned and mismatched spaces where a Bay Area mix of users who may share nothing more than a preference for stucco and gingerbread over glass and steel will go about their supposedly apolitical business. This may not seem like much on an institutional level, but I like to think that this contemporary user will miss exploiting natural ventilation when at home, the chance encounter in a sky lobby, the charge of an environment filled with newness, and above all the feeling of feeling virtuous. In this age of global warfare fought in local theaters of operations, the common denominator of what Mayne likes to call his singular buildings and suicide bombings turns out to be just one person at a time. This person is no longer intrinsically innocent and sacrosanct, no longer amasses into a necessarily virtuous community, and no longer occupies a preternaturally demilitarized zone called "public space." This person is a target, one that architecture like that of Morphosis—once understood to be autonomous because it focuses its effects on individual experience rather than institutional program—has both a new obligation and potential to explosively engage. ■



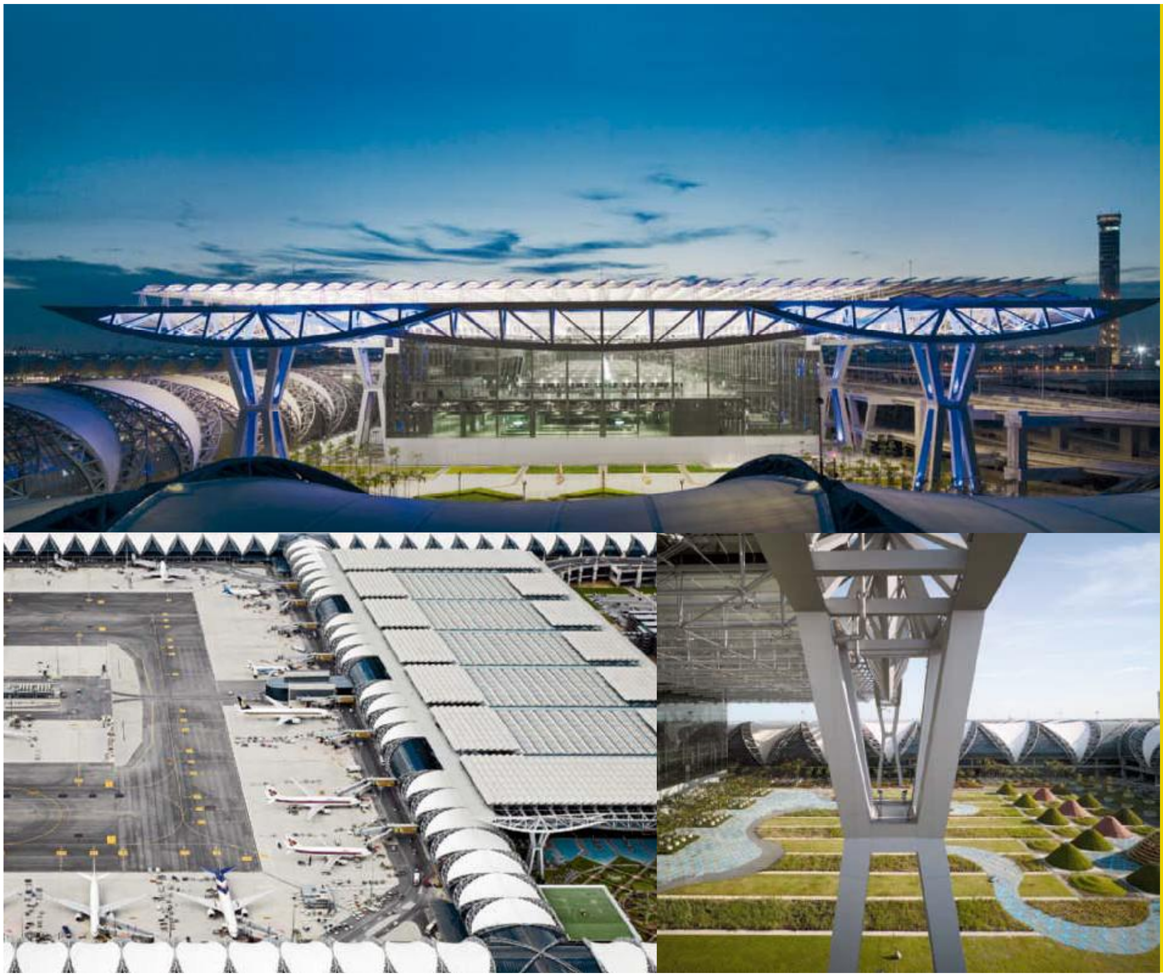
The sky lobby, outlined by a neon installation by James Turrell, is open to the public and provides spectacular views of the South of Market neighborhood and downtown.

Murphy/Jahn joins engineers Werner Sobek and Matthias Schuler to bring **SUVARNABHUMI AIRPORT**, Bangkok's sleek new air terminal, in for a landing





The terminal has a central pavilion (1) beneath a great cantilevered canopy, long tubular concourses (2) extending out from under the roof, and paired parking structures (3) in front of the main building, along the entry road. The envelope enclosing the concourses (above and left) incorporates tensile fabric with glazing and curved steel trusses. The concourses provide access to the jetway gates (left).



Photographer Rainer Viertlboeck's highly interpretive pictures emphasize the building's nearly monochromatic silvery-gray palette in contrast to cobalt-blue lighting by Yann Kersalé of AIK (opposite and this page, top). Geometric gardens flank the main pavilion (near left). Though the design offers many jetway gates (far left), bus-to-plane transfers are common here.

PHOTOGRAPHY: © RAINER VIERTLBOECK

By John Morris Dixon, FAIA

As a national capital and a regional crossroads of commerce and tourism, Bangkok has long supported one of the world's busiest airports—currently 15th in passenger volume. In designing Suvarnabhumi Airport, the city's new international hub, Chicago-based architects Murphy/Jahn realized from the outset that the passenger terminal would need to accommodate a vast scale of operations and express its pivotal importance to Thailand. Suvarnabhumi, meaning "land of gold," has a capacity of 45 million passengers annually, with 56 jetway (plus 64 bus-to-plane) gates, served by some 6 million square feet of floor area. Planned subsequent phases will increase its capacity to 100 million passengers per year.

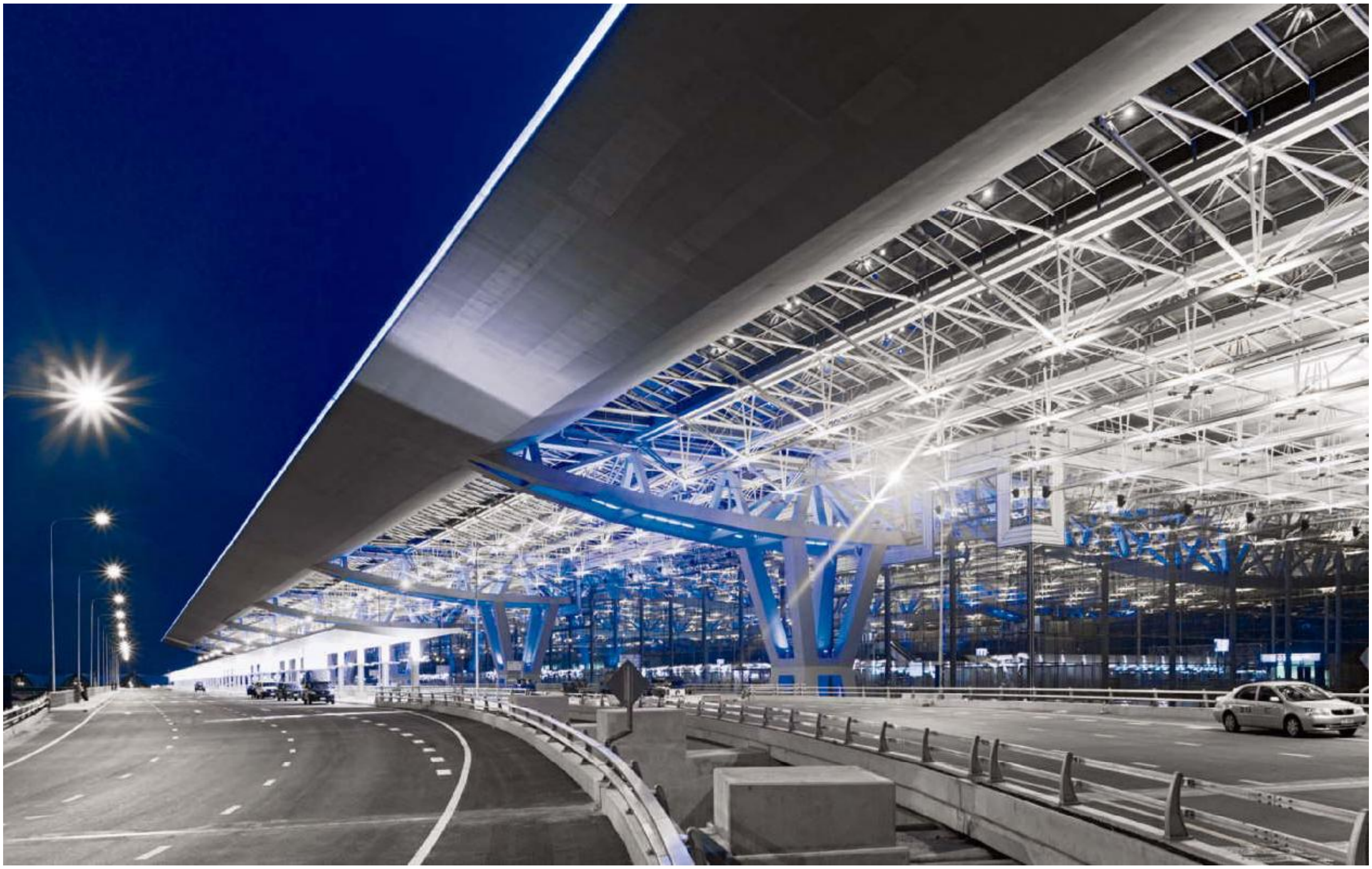
The design, winner of an invited international competition held in 1994, presents a powerful image: a lofty pavilion under a gigantic canopy hovering over an area exceeding 1.2 million square feet, with tubular concourses extending from it. Though the concourses feature the kind of emphatically repeating structural modules that characterize entire recent air terminals, such as Norman Foster's in Hong Kong [RECORD, November 1998, page 92] or Richard Rogers's in Madrid [RECORD, October 2005, page 150], Suvarnabhumi rises to a dominant central volume. Like those other major airports, however, Bangkok's could not have been realized without feats of structural engineering. It also demanded significant rethinking of interior climate control.

Since opening in late 2006, Suvarnabhumi has faced more than the usual spate of start-up stumbles and critical press. Objections—focused on everything from circulation, seating, and restrooms to cracked runways—have been intensified by accusations of corrupt construction management and concession leasing. Some scheduled, nonconnecting flights have already been shifted back to the new airport's dowdy but dependable predecessor, Don Muong, a facility that was to be relegated to private and military aviation.

Since Suvarnabhumi represents a huge public and private investment, said to exceed $3 billion, including aircraft-maintenance facilities, parking garages, and a hotel (in addition to the sleek new highway connecting the terminal to the city and the mass-transit link currently under construction), the airport management is trying to address the problems. Many of the functional shortcomings stem from retail operations that far exceed the scheme's intended capacity, plus ad

John Morris Dixon, FAIA, is former editor in chief of Progressive Architecture.

Project: *Suvarnabhumi Airport, Bangkok*
Architect: *Murphy/Jahn*
Associate architect/engineer: *ACT*
Project manager: *TAMS/Earth Tech*
Engineers: *Werner Sobek Ingenieure (structural concept, concourse superstructure, facades); Transsolar Energietechnik (climate and environmental concept); Martin/Martin (main terminal superstructure); John A. Martin & Associates (structural concrete); Flack + Kurtz (m/e/p)*
Consultants: *AIK—Yann Kersalé (lighting art); BNP (baggage)*
General contractor: *ITO Joint*



hoc counters for newly proliferating budget carriers.

Initial glitches aside, the airport will clearly remain Bangkok's key connection to the world, and the building's sheer size and structural bravura are bound to impress any traveler. Since the approach to the terminal must pass a gauntlet of ancillary buildings by other firms, including the new hotel, right along the main axis, Jahn has always considered it crucial that the terminal's central volume assert its primacy. (Fortunately, these new foreground structures have turned out quite discreet and neatly organized.)

As creative as the structural solutions, but scrupulously inconspicuous, is the innovative climate engineering (not called "mechanical engineering" by any of the participants). Throughout the design process, the architectural, structural, and environmental efforts were interwoven, transcending conventional hierarchies of architects and engineering consultants.

But the engineers who made it all possible were not yet involved when the scheme won the project competition. Once those consultants came on board, it became apparent that the proposal's scale demanded exceptional engineering, both to make the structure itself feasible and to manage the energy to operate it. The architects found ideal collaborators in two Stuttgart engineering firms: Werner Sobek Ingenieure, for structural issues, and Transsolar Energietechnik, for climate control.

Murphy/Jahn principal Helmut Jahn speaks of the collaboration as a transformative experience. "This was the first time in 30 years that I learned something new from engineers," he says. The joint effort "to elevate systems and construction to a level of art," he adds, required "the architect to think more about the technical consequences of his forms and the engineers to consider the aesthetic implications of their concepts."

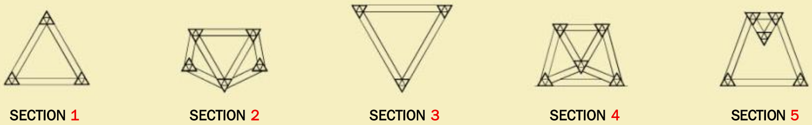
So effective was this collaboration that Murphy/Jahn went on to work with the same engineering firms on several other projects over the past decade, as the Bangkok airport proceeded by fits and starts. Sobek joined forces with the architect on the Munich Airport Center and Cologne-Bonn Airport facade, and all three firms collaborated on Bonn's Deutsche Bank Headquarters tower, Munich's Highlight Business Towers, Geneva's Serono Headquarters, and in Leverkusen, Germany, the Bayer Headquarters.

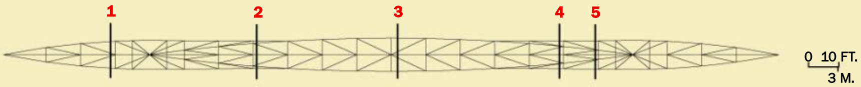
A major consideration in the Suvarnabhumi collaboration was Bangkok's intensely tropical heat, humidity, and sunlight. So the team designed the great canopy "floating" above the terminal's central hall to admit controlled rays while providing essential shading for glazed exterior walls and landside roadways. With no interior columns under this 689-by-1860-foot roof plane, the design dictated clear spans of a magnitude more often encountered in bridges. Eight 2,710-ton trusses—each spanning 413 feet, with 138-foot cantilevers at both ends—support the canopy. In silhouette, these trusses essentially diagram the bending moments acting on them, with the greatest depth at midspan and over the supports. Taking this full-scale structural lesson further, each truss changes in cross section, depending on which chord, upper or lower, is in compression: Paired members signify compression and single ones tension, since the latter condition requires less steel for comparable loads.

These megatrusses make possible a column-free space of urban

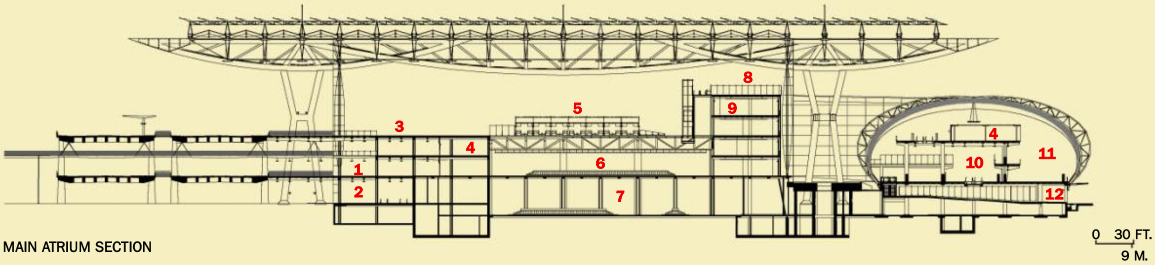
Structural feats made the competition-winning scheme possible

Designed by Murphy/Jahn, the main control tower is reportedly the world's tallest, rising 434 feet (near right). The central pavilion's 689-by-1,860-foot roof plane allows for a vast column-free interior. Eight 2,710-ton trusses—each spanning 413 feet, with 138-foot cantilevers at either end—support the canopy. These trusses, changing often in cross section (below right), are essentially diagrams of the bending moments acting on them, with the greatest depth at midspan and over the supports. The curved five-point trusses in the concourse (opposite) hold alternating sections of tensile fabric and glazing (far right and opposite, left).



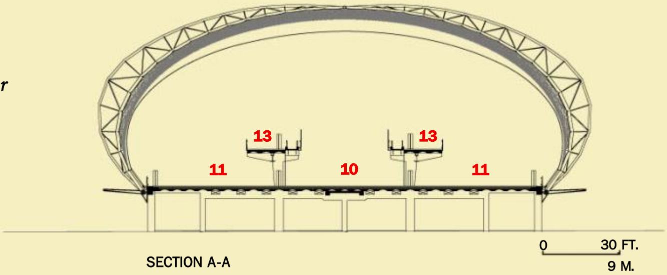


MEGATRUSS PLAN

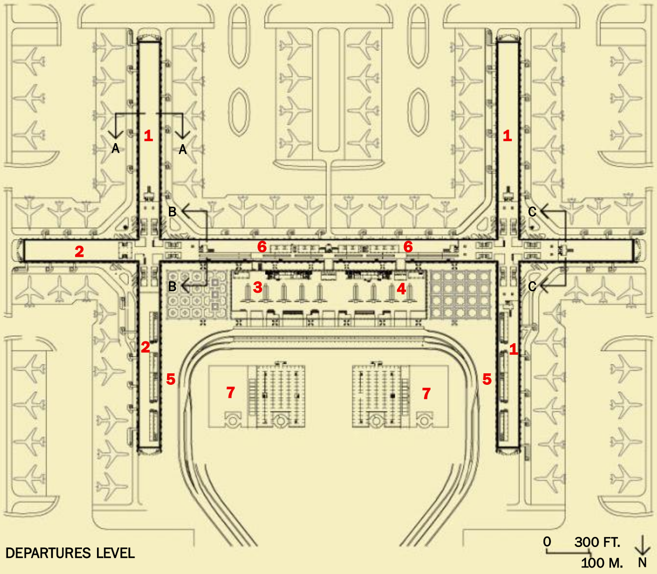


MAIN ATRIUM SECTION

1. *Arrivals lobby*
2. *Bus lobby*
3. *Departure lobby*
4. *Retail*
5. *Check-in counters*
6. *Baggage claim*
7. *Baggage make-up hall*
8. *Restaurant/observation deck*
9. *Office*
10. *International arrivals corridor*
11. *International hold room*
12. *Bus gate*
13. *International departures corridor*
14. *Domestic departures corridor*
15. *Domestic arrivals corridor*
16. *Lavatory*
17. *Waiting lounge*
18. *International airline lounge*



SECTION A-A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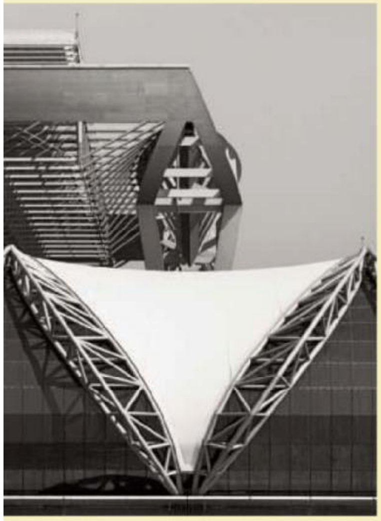
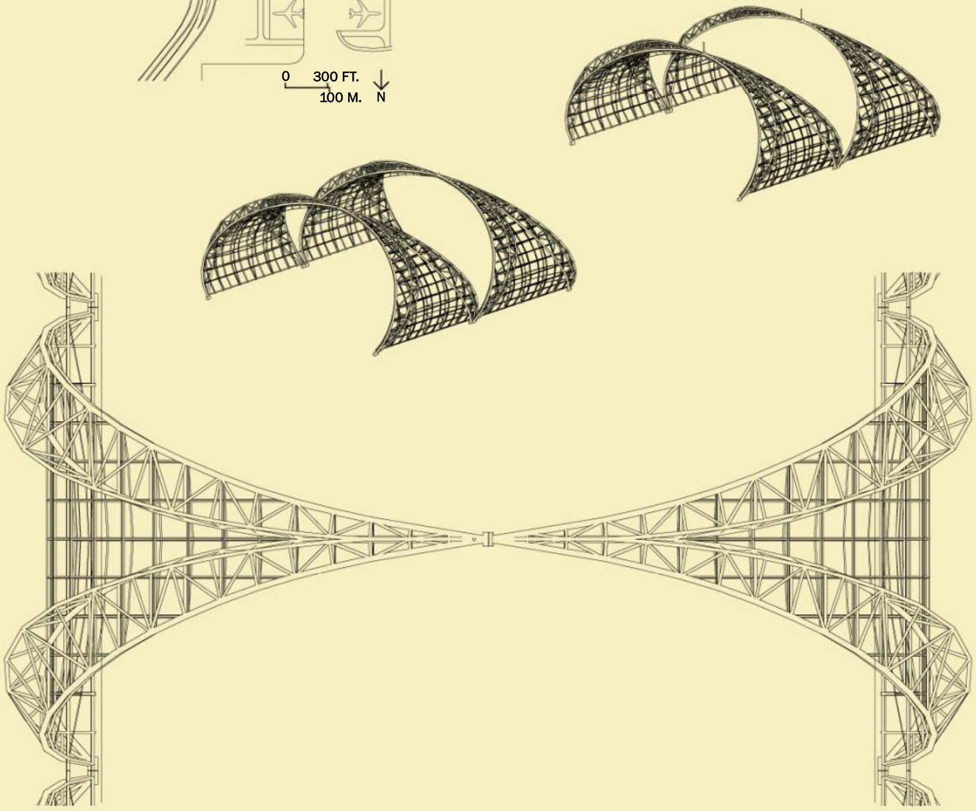
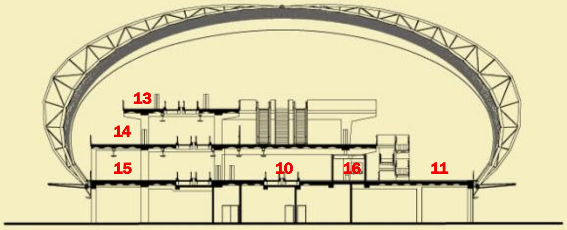
DEPARTURES LEVEL

1. *International gates*
2. *Domestic gates*
3. *Domestic check-in*
4. *International check-in*
5. *Offices*
6. *Retail*
7. *Parking*





CONCOURSE TRUSS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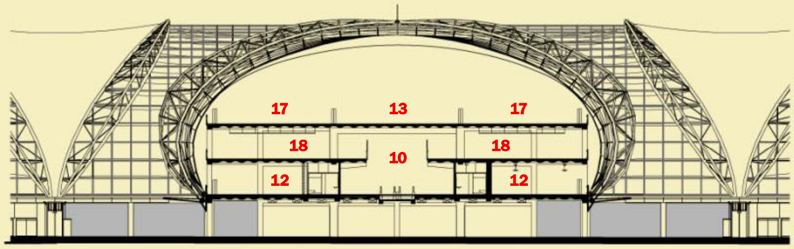
SECTION B-B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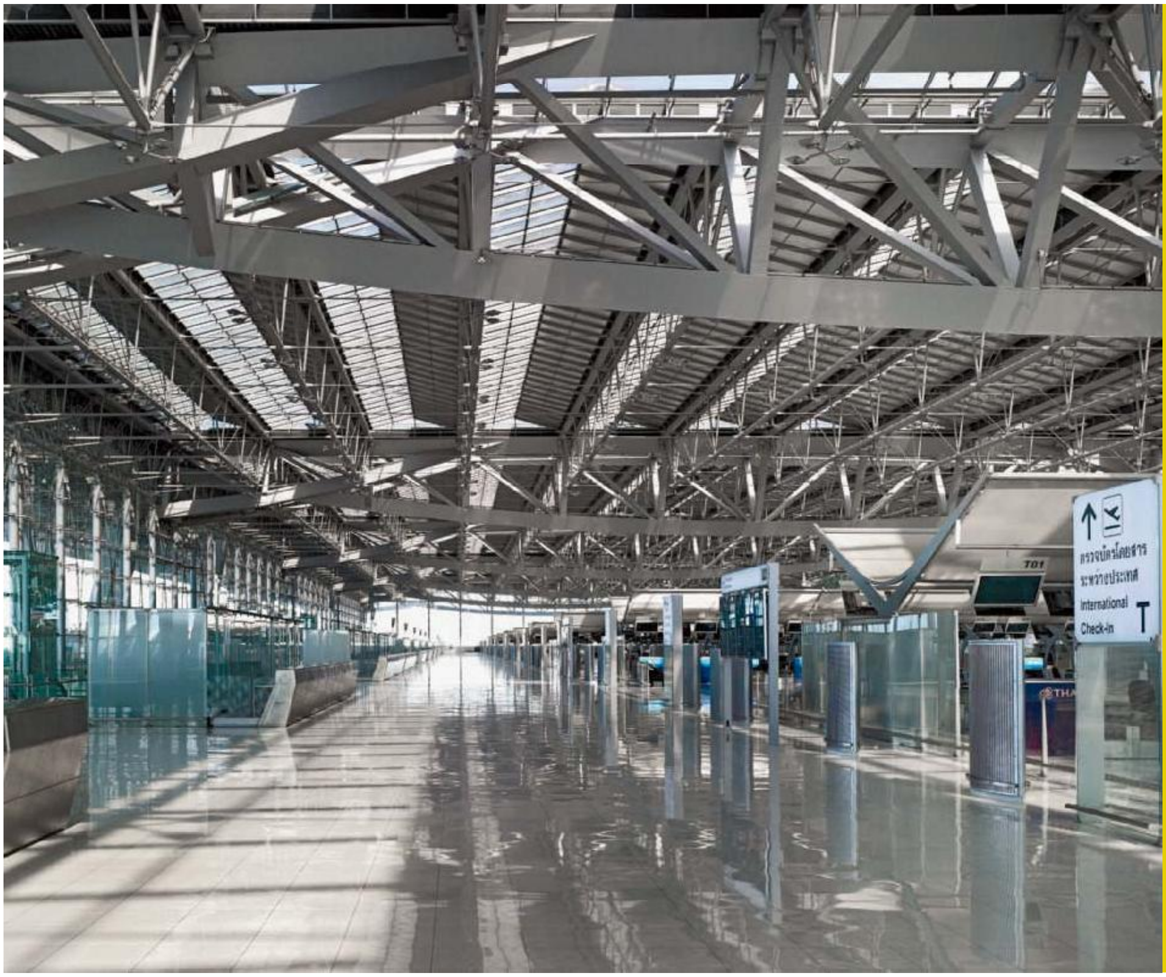
SECTION C-C



On the roadside, the central pavilion reveals its structural bravura through a great transparent, cable-supported facade (opposite). A key function of the roof canopy (left) is to admit enough sunlight to eliminate the need for electric illumination during the day. Since a remarkably small fraction of the ambient light fulfills this need, the architects and engineers gave the roof a ripple of low-sloping planes with opaque aluminum-clad panels facing south, and glass fritted to 95 percent opacity facing north.

proportions. Enclosed within cable-supported walls of clear glass, this area constitutes a vast plaza with check-in counters, as at so many airports, lined up like booths in a market square. While the truss-supported canopy overhead is impressive for its structural accomplishment, its sheer scale and mass can also seem oppressive during the day when its forms are cast in shadow. But by night, blue and white light bathes the massive structural elements, making them look almost buoyant.

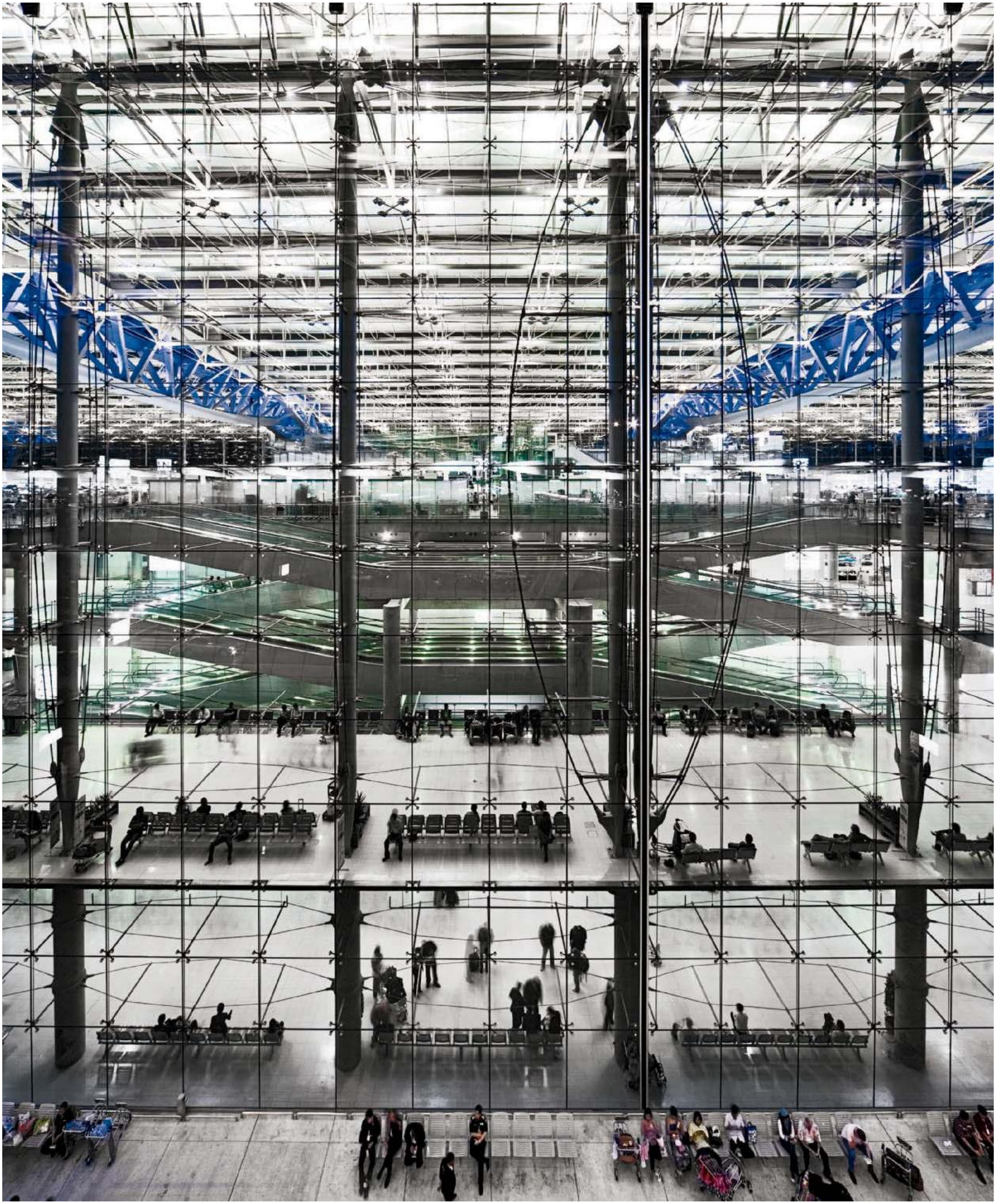
Lighting consultant Yann Kersalé of AIK chose the cobalt-blue glow to single out the main pavilion from the airport's diverse nighttime sources of illumination. Metal halide lights the columns, blue fluorescent the trusses, and blue neon the canopy's edges, with these three fixture types adjusted to achieve essentially the same color. (Jahn had integrated intensely hued lighting into an airport before, as in the 1987 United Airlines Terminal One Complex at Chicago's O'Hare International Airport.)

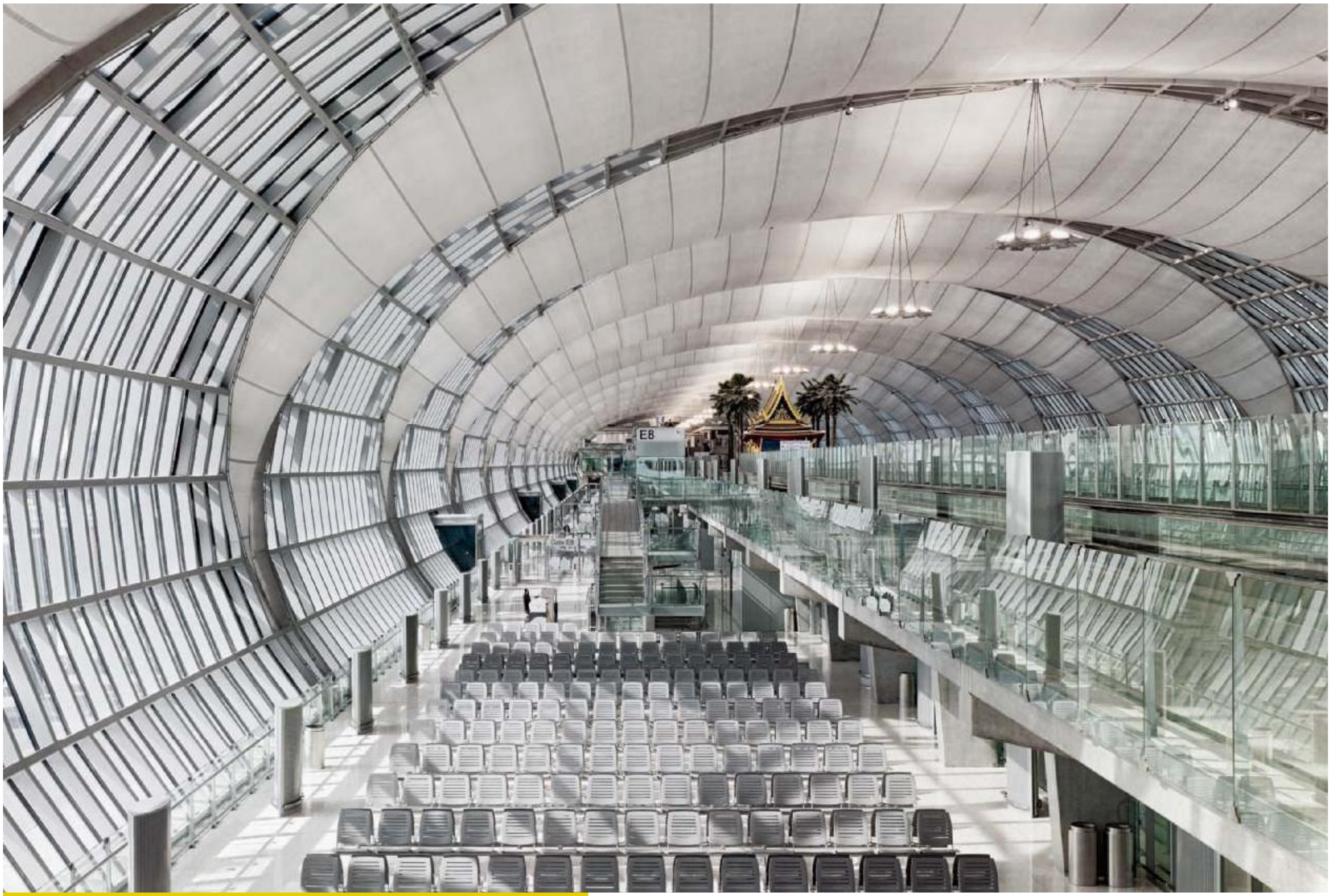
By day, a key function of the canopy is to admit enough sunlight to eliminate the need for electric illumination. Since a remarkably small fraction of the ambient light fulfills this need, the design team gave the roof a ripple of low-sloping planes with opaque aluminum-clad panels facing south, and glass fritted to 95 percent opacity facing north. Fixed exterior, aluminum louvers, engineered to cut out all direct rays, also shade portions of the canopy.

Even with modulated sunlight and deep overhangs, the resources required to air-condition the entire central volume to passenger-comfort levels (with a 75-degree Fahrenheit maximum and 50-to-60 percent relative humidity) would have been inordinate. This dilemma presented an ideal challenge for Transsolar principal Matthias Schuler, whose climate-engineering goal is to minimize, rather than simply fulfill, mechanical demands. For this 47-foot-high space, the firm proposed conditioning only the inhabited layer—roughly up to 8 feet above the floor in both the central hall and concourses—effectively halving the air-conditioning's energy and installation demands.

The key to stabilizing this air layer was cooling the floor slab with embedded tubes of chilled water in closed loops. By offsetting the radiation striking the floor, this "radiant slab" eliminates the destabilizing heat that would otherwise rise from it—as virtual and physical models confirmed. Cooling the floor also maintains passenger comfort levels with less air-conditioning, bringing added savings. Throughout the terminal, shoulder-high pylons, lens-shaped in plan to minimize interference with passenger circulation, supply low-velocity, conditioned air. And this stratified-air concept eliminates the glazed envelope's need for thermal insulation above the conditioned "layer." Since the upper reaches usually get warmer than the outside air, the negligible insulation value of single glazing at those heights actually helps dispel heat.

KEY TO THE CLIMATE-CONTROL SOLUTION WAS COOLING THE FLOOR SLAB WITH EMBEDDED TUBES OF CHILLED WATER.

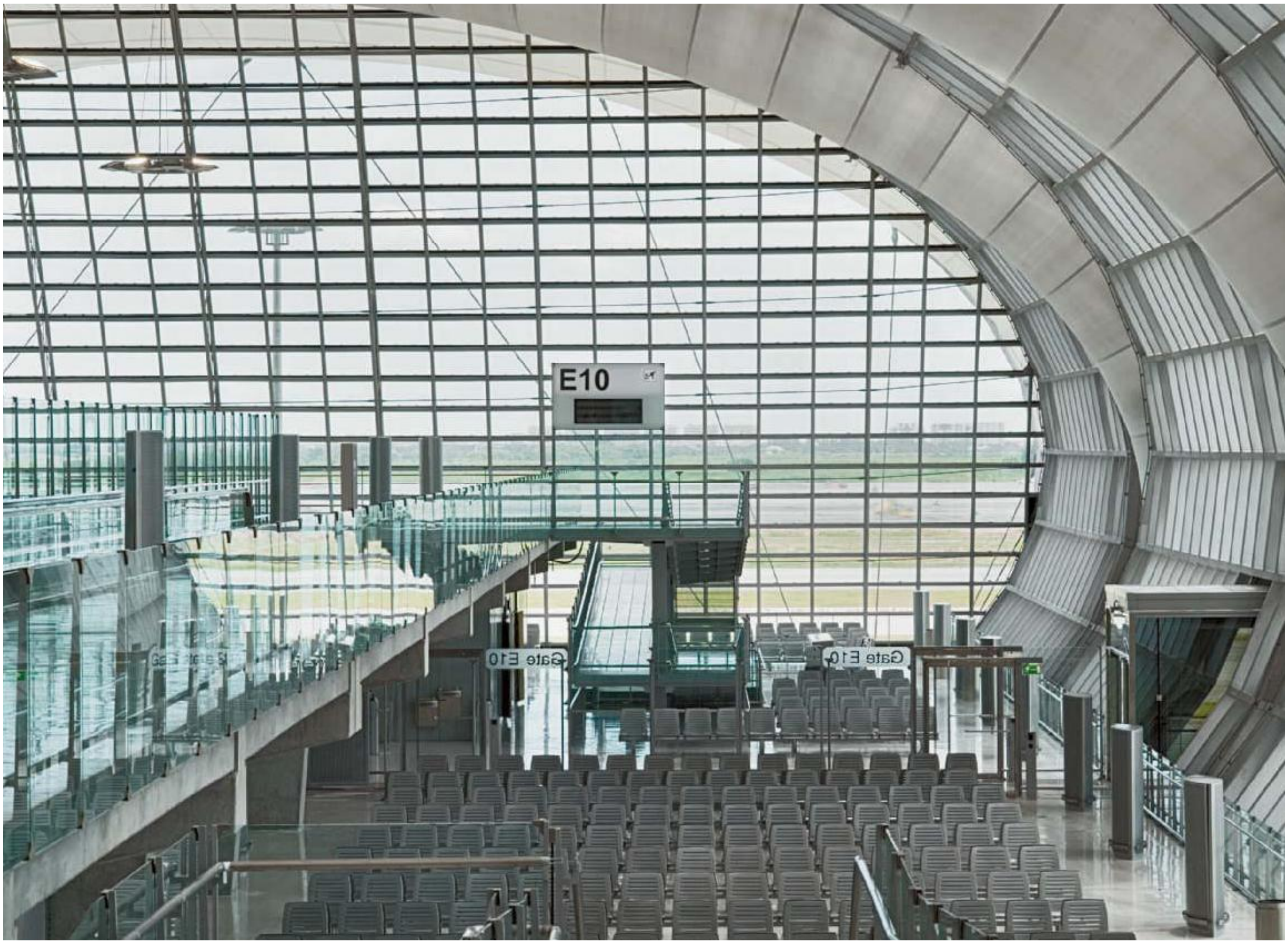




With the intent of retaining clear views through the luminous, tubular concourses, the architects created various spatial configurations within them, inserting different levels for gateside waiting (above) versus larger circulation zones (opposite). Daylight even fills the baggage-claim area (below).

The concourses embody another structural tour de force, very different from that of the super-scaled canopy. These tubular appendages, providing access to the gates, took the same overall form even in Murphy/Jahn's competition entry, but the real integration of architecture with structural and climatic engineering came through the execution of these elements. The team configured the envelope's alternation of tensile fabric with areas of glazing so that the glass sections (defining curved triangles) remain nearly continuous at eye level. Overhead, the fabric canopy and the glazing, which progresses from a 20 percent opaque frit at its base to 80 percent at its peak, produce effective shade. Structurally, the tubular form spans the concourse's 89-foot width with five-point trusses—a configuration suggestive of linked wishbones.

A daunting set of structural, thermal, acoustic, and illumination demands challenged the design of the tensile fabric, resulting in a membrane of three layers: an outer structural and weatherproofing surface composed of polytetrafluoroethylene (PTFE)-coated, high-performance glass fiber; a middle airtight layer of polycarbonate panels, which block out aircraft noise, absorb interior sound, and stiffen the membrane against wind; an inner skin of open-weave glass fiber, transparent to sound; and an aluminum coating that reflects outside heat back toward the exterior. While the membrane is heated by lighting and occupancy on the inside, and by sunlight and the ambient air temperature on the outside, the metallic coating keeps heat from radiating to the interior. "Otherwise," says Stefan Holst, Transsolar project manager, "[the skin] could act as a big



radiator." This fabric sandwich has earned worldwide patents.

While the concourse envelope transmits only 1 to 2 percent of the available sunlight, it eliminates the need for daytime electric illumination. (Even with a graduated frit, the glazing appears entirely clear from the interior.) After dark, the metallic inner surface becomes an effective reflector for indirect lighting.

While the terminal's program has always included a very large shopping component—key to today's commerce airports—retail operators were permitted to expand far beyond the areas allocated in the design, without the architect's input or approval. To make way for this unplanned retail, four pairs of moving walkways (totaling 827 feet of walking distance) were eliminated, some proposed seating was displaced, and circulation routes constricted. Sight lines, intended to remain open and ease wayfinding, were obstructed. Management issues seem to lie behind other passenger inconveniences, such as the frequent busing to international flights even while numerous jetway gates stand idle. Repairs to faulty taxiway paving may account for some of this practice, coupled with the airlines' resistance to jetway "docking" fees that run significantly higher than at the old airport.

In the departure hall, budget airline stations now constrict the space and interfere with clear views from drop-off curb to ticket counters. In the arrivals hall, unplanned commercial kiosks crowd the area allotted for travelers to meet friends, associates, and drivers. And an initial overload on restrooms apparently resulted, in large part, from an unanticipated surge of local sightseers outside of security-screened areas, with some picnicking and staying for hours. Although those crowds are expected to dwindle, the airport is strategically inserting extra restrooms.

In zones reserved for future expansion at either end of the central pavilion, the airport now presents gardens, designed by RPU Landscape Design Group, with geometric and organic forms drawn from Thai tradition. While these areas remain accessible, the designers conceived them primarily to be viewed from a level or two above—with entry points isolated from passenger routes. And to traverse the Jungle Garden, designed by NT Architects for a space between the main pavilion and the parallel concourse, visitors must remain within glazed passageways.

In the larger scheme of things, the terminal's present functional deficiencies are prime examples of a truism: The client, whose building it is, can subvert even the best design intentions. Given the widespread objections and huge investment in this airport as a national symbol, the management is likely to reverse some of its unfortunate physical changes, enhancing the interior's experiential qualities and restoring a portion of the ample passages and uncluttered vistas that Murphy/Jahn envisioned. For designers of future public facilities, Suvarnabhumi Airport bears lessons, both inspirational and cautionary; and for passengers, the remedial measures should offer greater chances for actual enjoyment of the terminal's exhilarating spaces. ■

For sources, see page 132.

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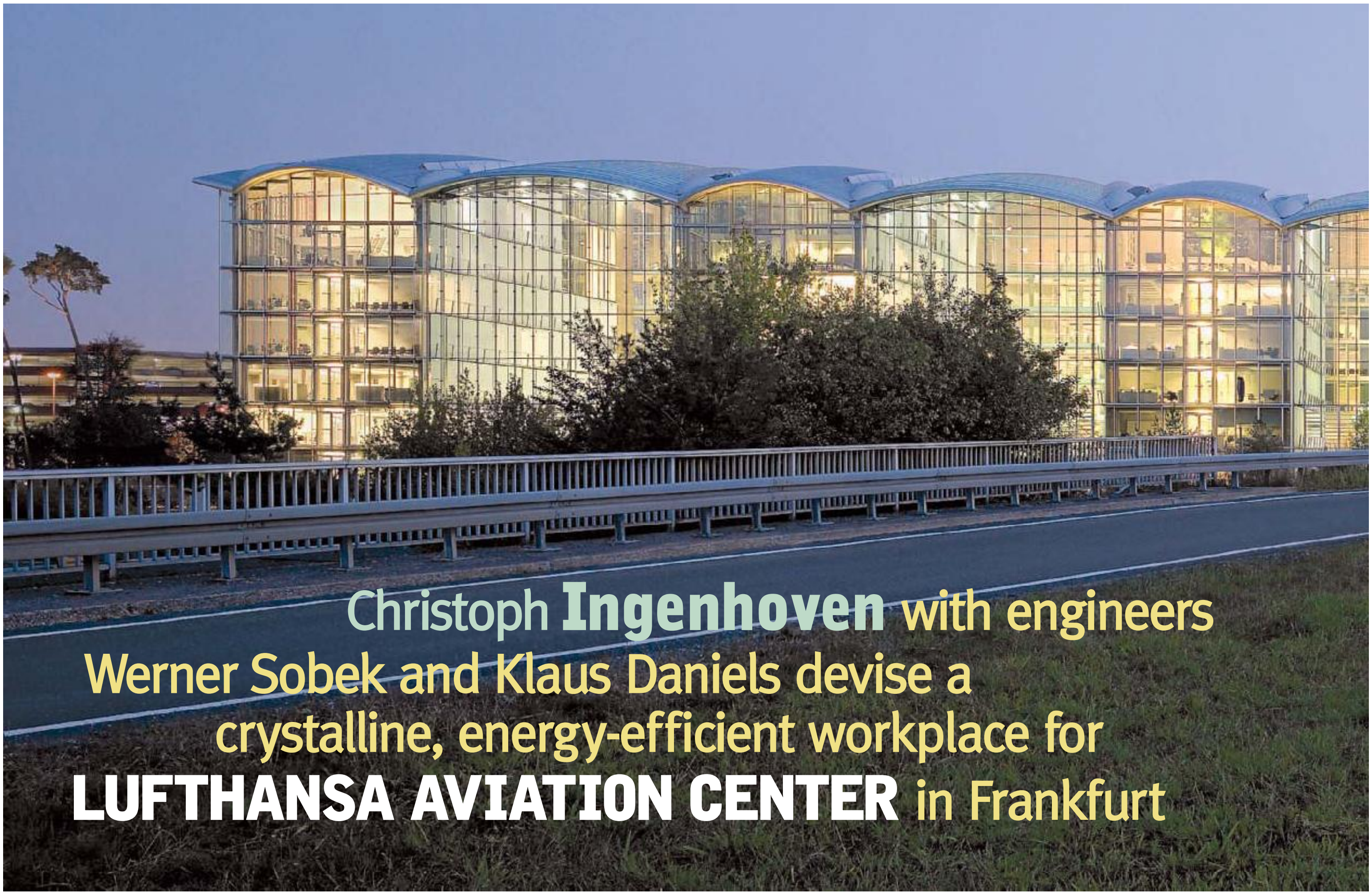
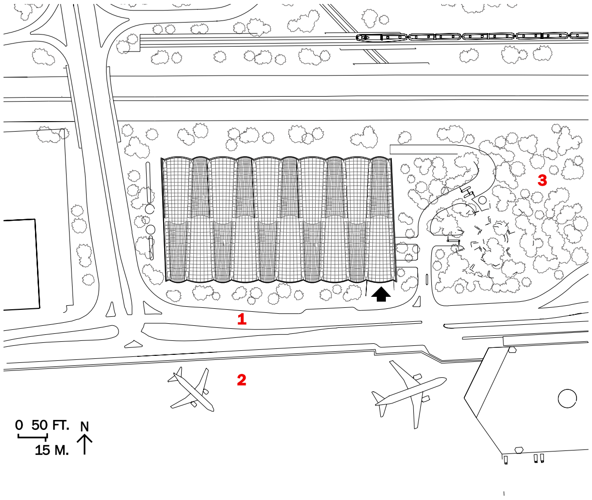
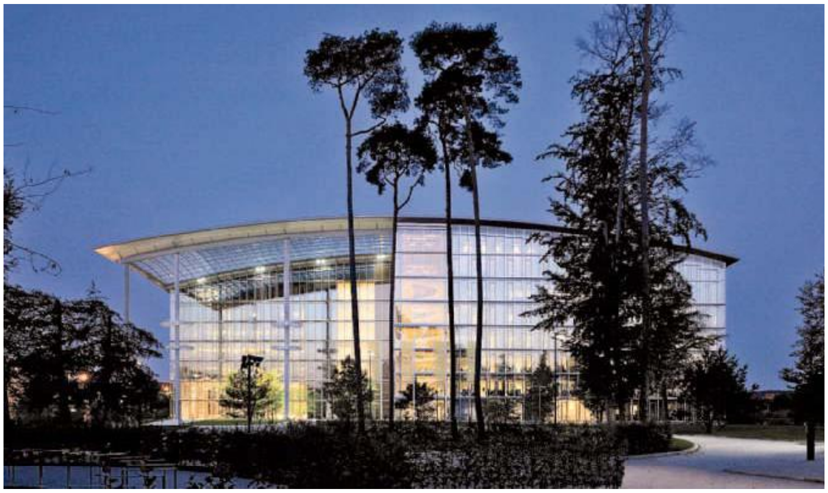
Submit your project to ***construction.com/community/gallerylist.aspx***.



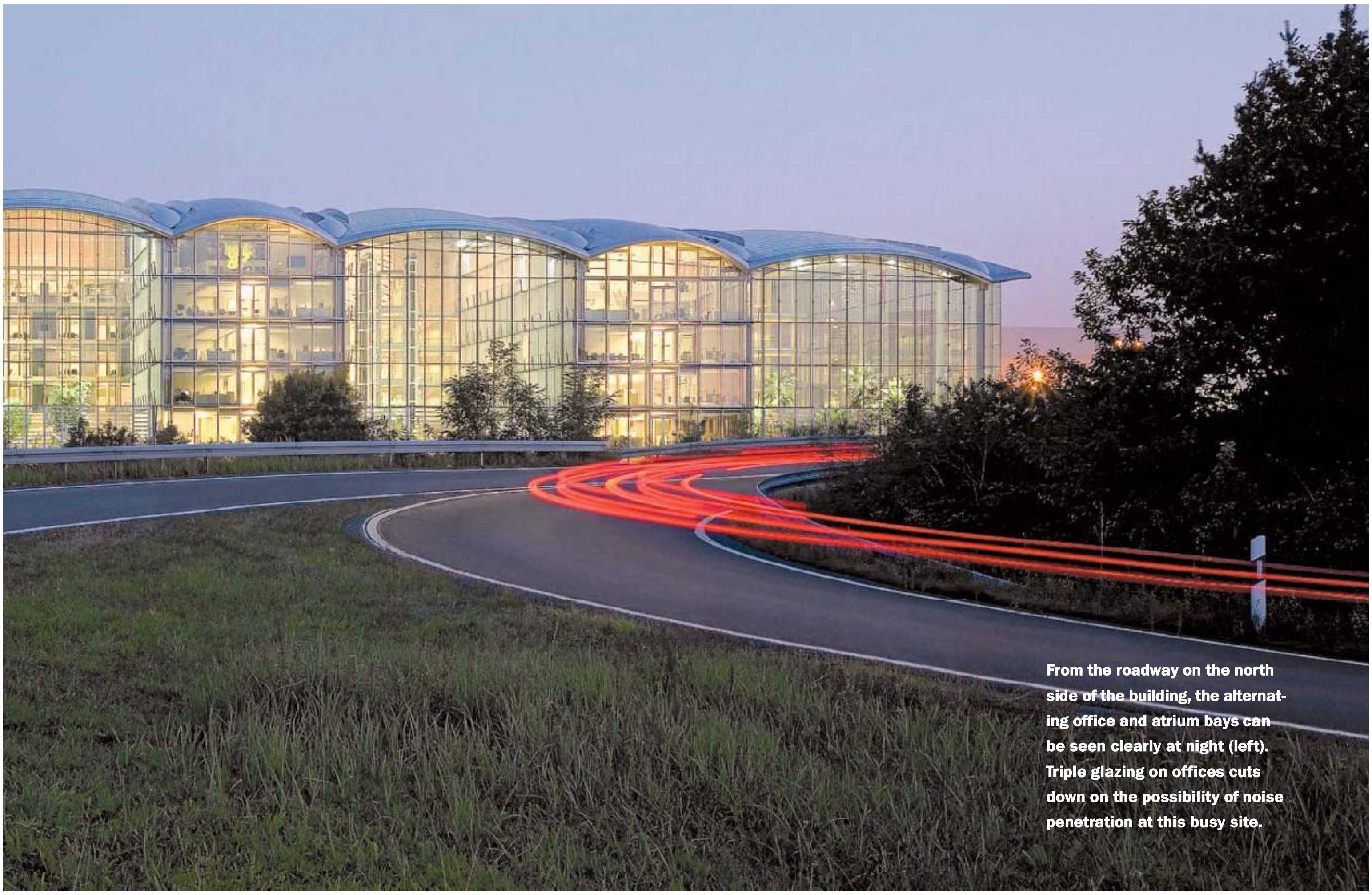
Christoph **Ingenhoven** with engineers Werner Sobek and Klaus Daniels devise a crystalline, energy-efficient workplace for **LUFTHANSA AVIATION CENTER** in Frankfurt

1. *Airport ring road*
2. *Frankfurt airfield*
3. *Space for future expansion and ramp to underground parking*





Ample glazing and a light concrete frame give the aviation center the appearance of an airy pavilion as one approaches it from the east end (above). The long, linear building, next to the airport, features skylit atriums and acoustically insulated offices.



From the roadway on the north side of the building, the alternating office and atrium bays can be seen clearly at night (left). Triple glazing on offices cuts down on the possibility of noise penetration at this busy site.

PHOTOGRAPHY: © H.G. ESCH,HENNEF

By Peter Cachola Schmal

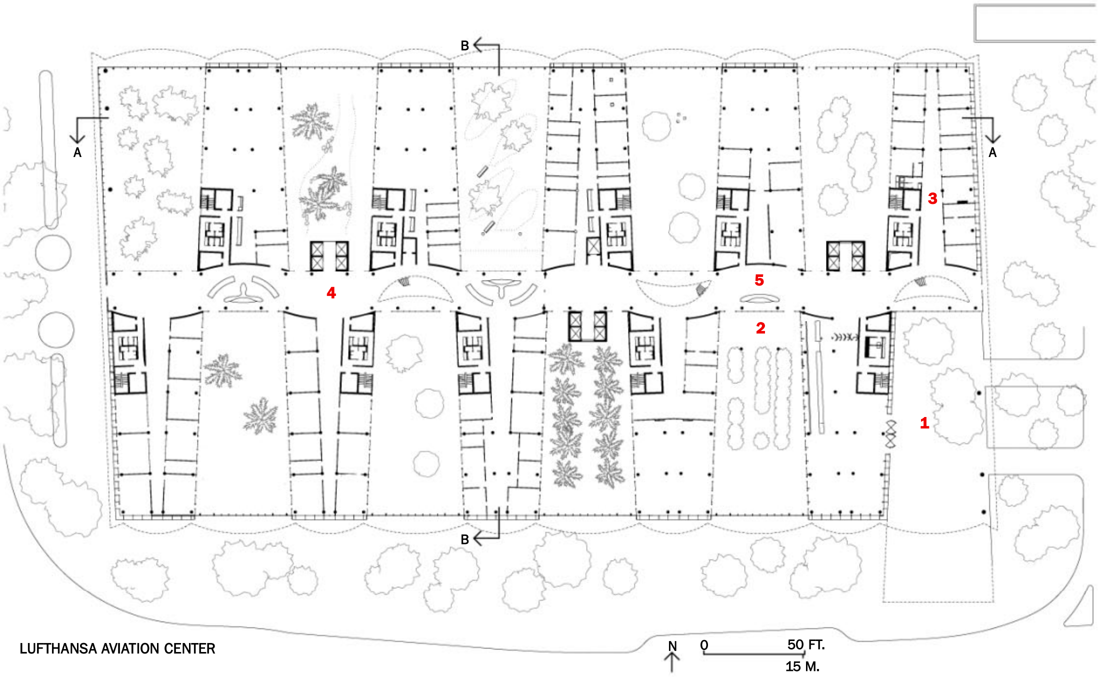
In recent years, Christoph Ingenhoven, who began his practice in 1985 in Dusseldorf, Germany, has emerged as a formidable player in the architectural market owing to an approach that emphasizes technology and sustainability. Although his 1991 scheme for the Commerzbank Tower in Frankfurt came in second to Norman Foster's proposal, his firm, Ingenhoven Architects, went on to design an elegant 416-foot-high tower for RWE (Rheinisch-Westfälishes Elektrizitätswerk), completed in Essen in 1997. It was, he says, the first ecologically oriented high-rise designed throughout with a double-skin glass facade for natural ventilation of office areas. Currently, Ingenhoven is working on towers in Luxembourg; Osaka, Japan; and Sydney, Australia.

Ingenhoven's major recent work in Germany, the new Lufthansa Aviation Center, is strategically located right next to Frankfurt airport—therefore subject to considerable constraints in terms of air pollution and noise emissions. The site is squeezed between one of the most heavily used German autobahns, the ICE high-speed railroad line from Frankfurt to Cologne, with the airfield to the south. Ingenhoven's competition-winning scheme for Lufthansa is a powerful modern structure, subdivided into 10 wings, and separated by fully glazed gardens that function as thermal buffer zones and provide fresh air to the office areas for Lufthansa's 1,850 employees. The overall envelope of double- and triple-layered glass, plus various climatic tools—such as the use of embedded hydronic-loop systems to activate the thermal mass of the exposed concrete surfaces in storing and dispersing heat or cold at a later time, along with additional heat-recovery methods, highly efficient sunshading, and air-ventilation systems—are impressive. All keep the thermal loss and energy consumption to a mere 355 kilowatt hours per square foot, such a low level that the building comes close to complying with the German standard for low-energy houses. These astonishing results are the product of close collaboration with climate engineer Klaus Daniels, founder of the pioneering climate consultancy HL-Technik. Ingenhoven also joined forces with structural engineer Werner Sobek (renowned for his close cooperation with Murphy/Jahn, see page 122) to define the shapes for both the glazed and concrete roof modules. The glazed atria roofs boast a free 60-foot span and consist of barrel-shaped grid shells of nonbending, welded rectangular steel sections. They connect to the likewise barrel-shaped concrete roofs covering the office spaces, which, while shell-like in appearance,

Peter Cachola Schmal, an architect and author, is the director of the Deutsches Architektur Museum, in Frankfurt, Germany.

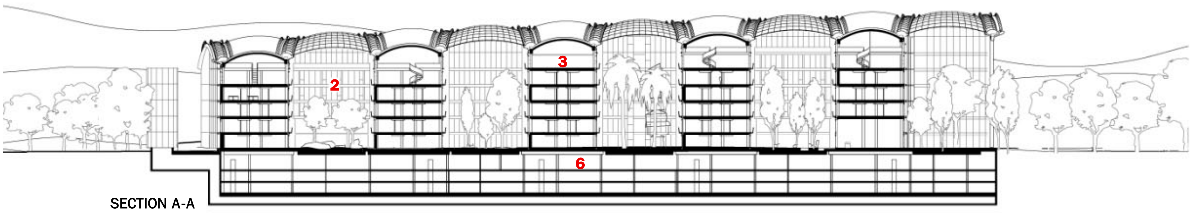
Project: *Lufthansa Aviation Center, Frankfurt, Germany*
Architect: *Ingenhoven Architects—Christoph Ingenhoven, principal*
Engineers: *Werner Sobek (structural); Klaus Daniels/HL-Technik, Brendel, Ebert (building services)*
Consultants: *DS-Plan (facade design); DS-Plan, Institut für Bauphysik Horst Grün (building physics); Tropp Lighting Design (lighting); WKM Weber Klein Maas (landscape design); Baumgartner & Partner (energy concept)*

The 10 bays of office banks and light-filled atriums, slightly wedge-shaped in plan, are placed so that the narrow ends of the office banks and the wide ends of the atriums face toward the outside. From the exterior, the landscaped atriums seem to dominate.

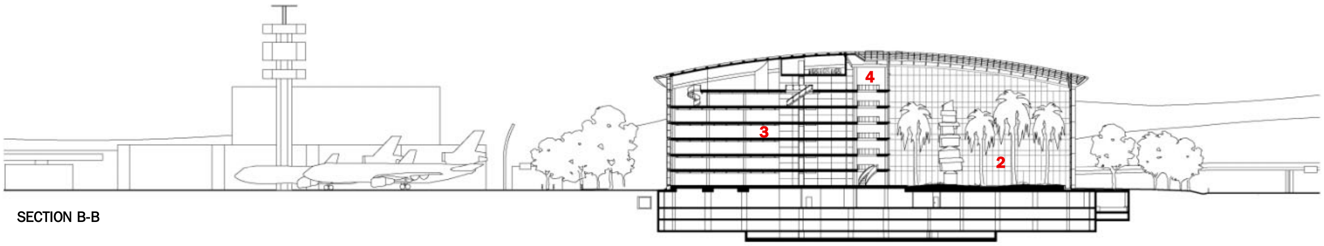


1. *Entrance portico*
2. *Atrium*
3. *Offices*
4. *Meeting points*
5. *Web terminals*
6. *Parking garage*

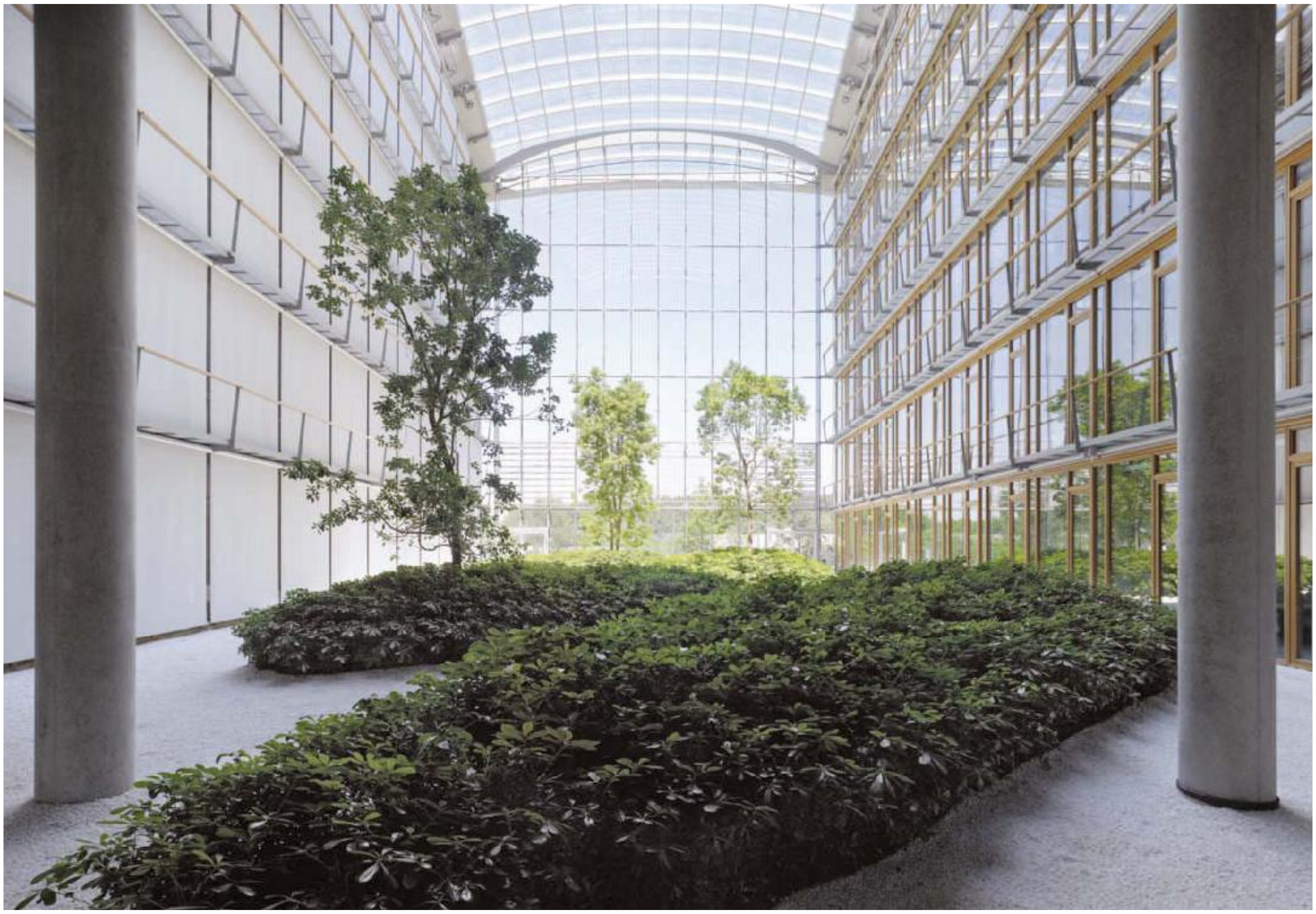
LUFTHANSA AVIATION CENTER

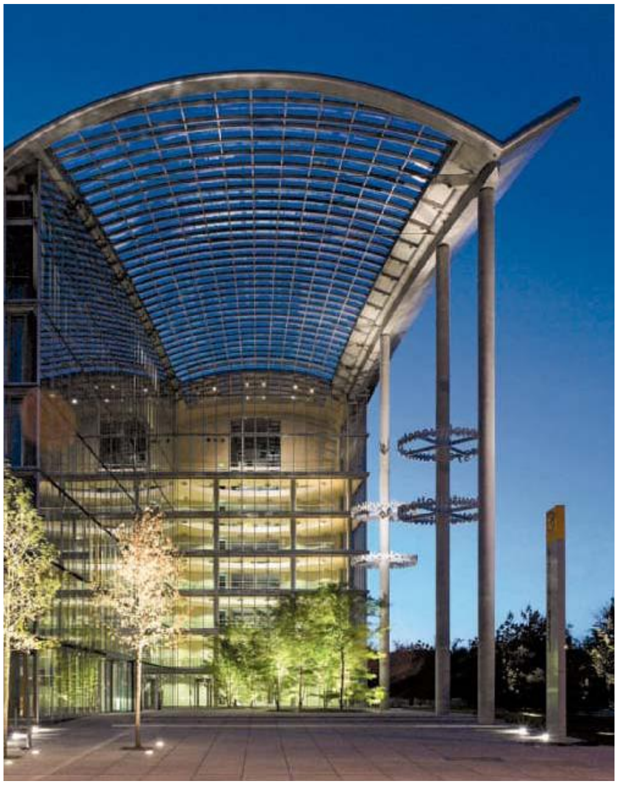


SECTION A-A



SECTION B-B

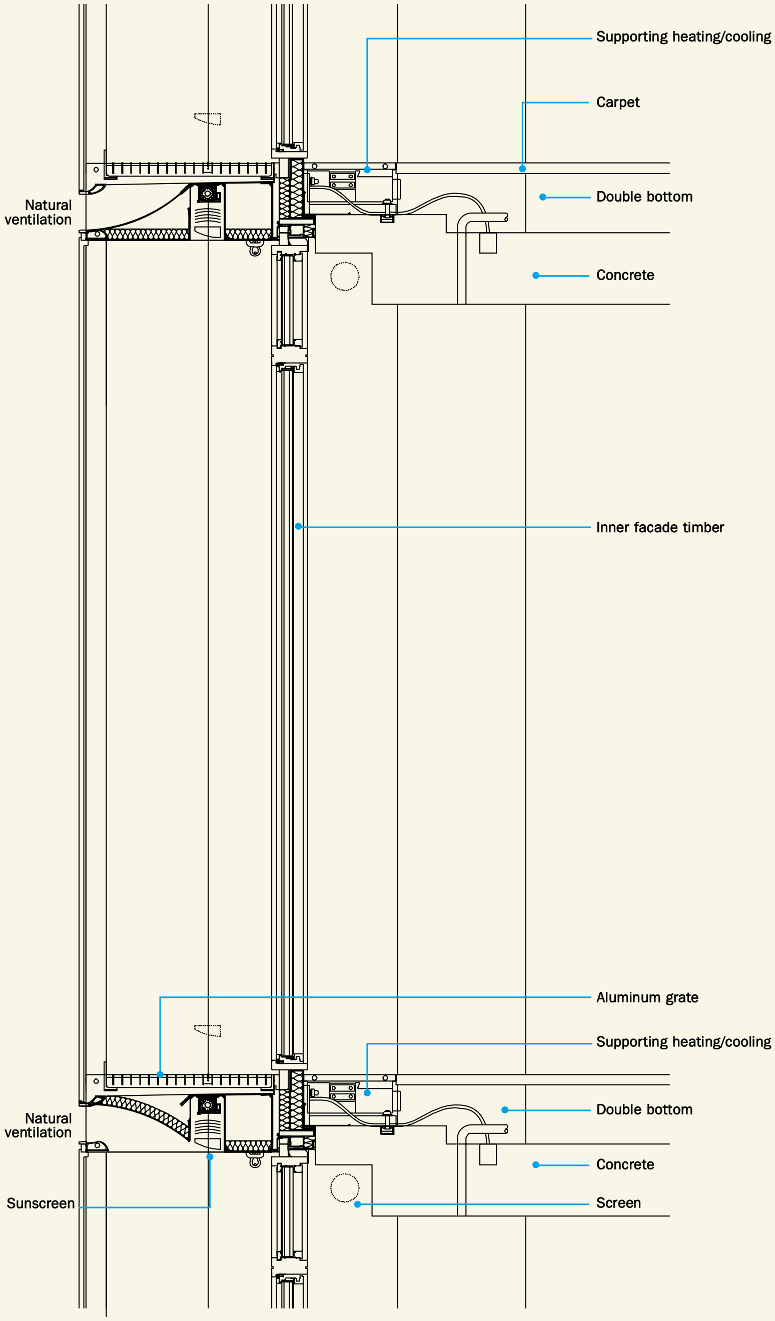




The roof of the entrance pavilion (left) and those of the atriums are double-curved steel grids with glass panels. Landscaping by WKM Weber Klein Maas uses plants from different regions to provide variety. Wood framing for interior glazing adds a natural tone to the whole.

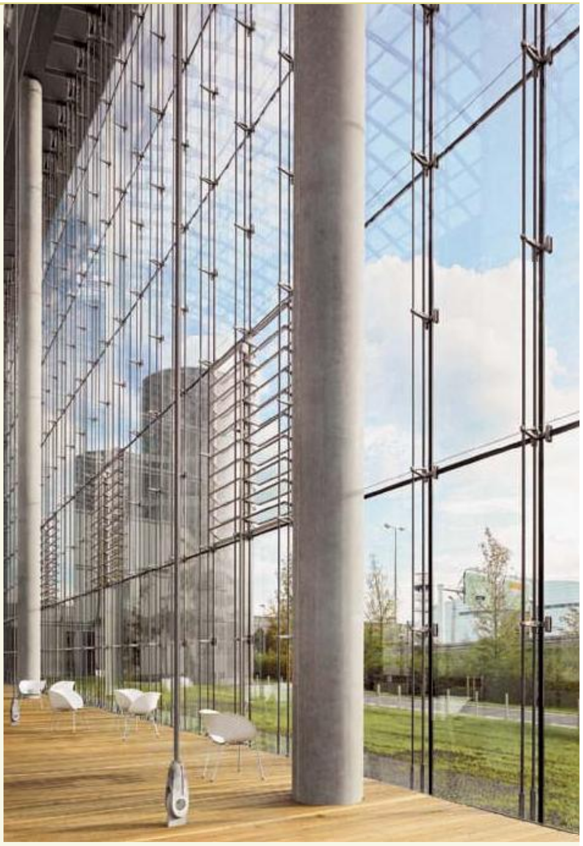
are basically bent, flat, 11-inch-thick slabs that rest on single high-performance concrete columns or cores. At the junction of the two roof systems, Ingenhoven introduced a special wing-shaped spoiler, based on aerodynamic experiments. The spoiler creates a permanently neutral wind-pressure zone above it, which helps suck exhaust air out of the atrium.

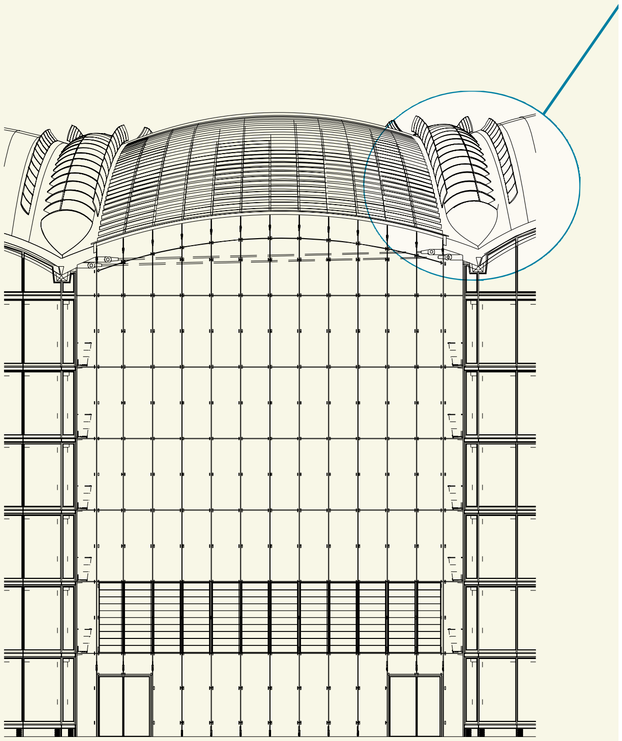
In addition to such elaborate technical details, the architects concentrated on creating a work environment aimed at fostering the well-being of the employees, with equally comfortable work spaces for all. High-quality insulation glass keeps the sound level inside the building amazingly low, and open-plan areas with fully transparent partitions walls bring in natural light in abundance. The main passageway, dotted with many cafeterialike stops, encourages informal meetings among employees. Unlike a customary stuffy corridor, Ingenhoven's exciting cutaway spatial structure fosters a variety of views into the multilayered building. On the ground floor, the gardens designed by landscape architects WKM Weber Klein Maas likewise contribute to the relaxing and airy atmosphere. The staff canteen is located on the highest floor, overlooking both the nearby Kelsterbach forest to the north as well as the airfield to the south, with huge photo prints by Thomas Demand of an artificial jungle decorating the wall. His site-


Supporting heating/cooling
Carpet
Natural ventilation
Double bottom
Concrete
Inner facade timber
Aluminum grate
Supporting heating/cooling
Natural ventilation
Double bottom
Concrete
Sunscreen
Screen

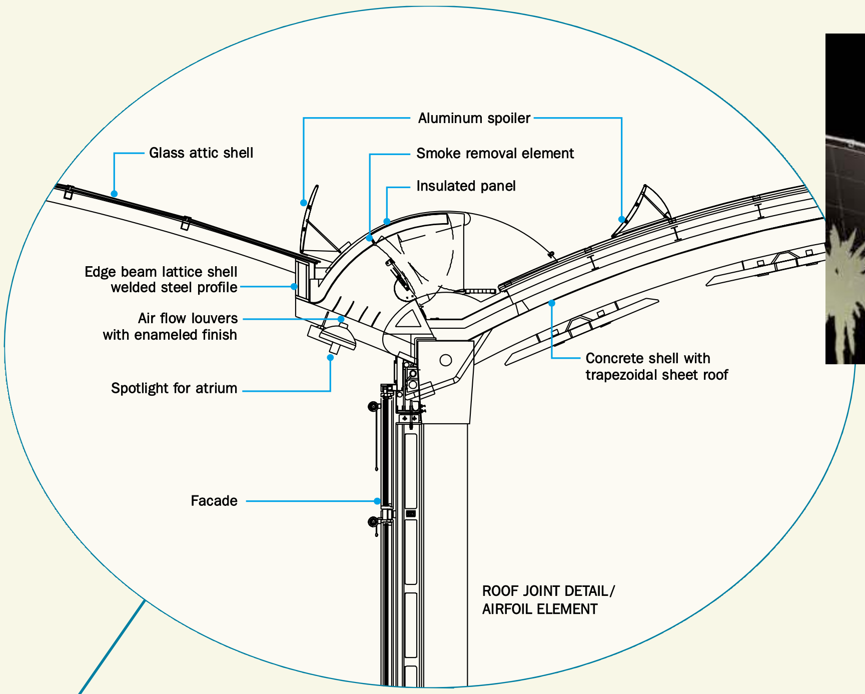
DOUBLE-SKIN FACADE DETAIL

The double-skin facade provides low-energy heating, cooling, and ventilation (section, above). Vertically tensioned cables in the atriums (top and bottom right) create a delicate framework for the glass.

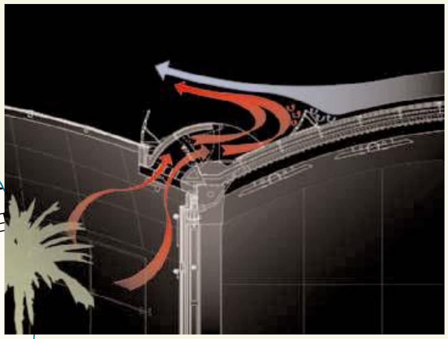


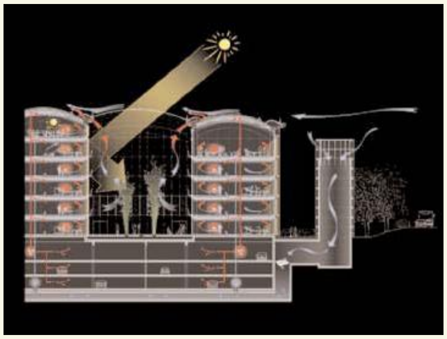


FACADE ATRIUM


Aluminum spoiler
Glass attic shell
Smoke removal element
Insulated panel
Edge beam lattice shell welded steel profile
Air flow louvers with enameled finish
Concrete shell with trapezoidal sheet roof
Spotlight for atrium
Facade

ROOF JOINT DETAIL/
AIRFOIL ELEMENT



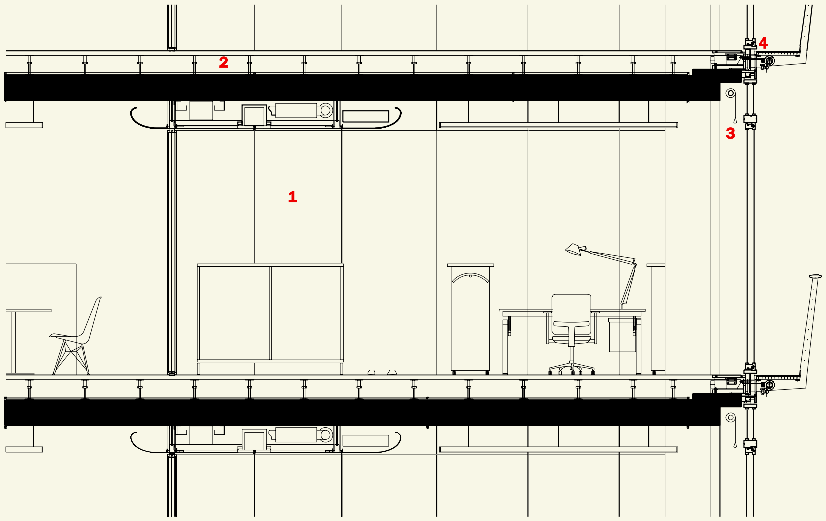


As the summer ventilation diagram shows (above), cool air is drawn through air-supply-intake stacks into the ground. As it moves up, it cools offices; warm air is then sucked up through airfoil units (top).

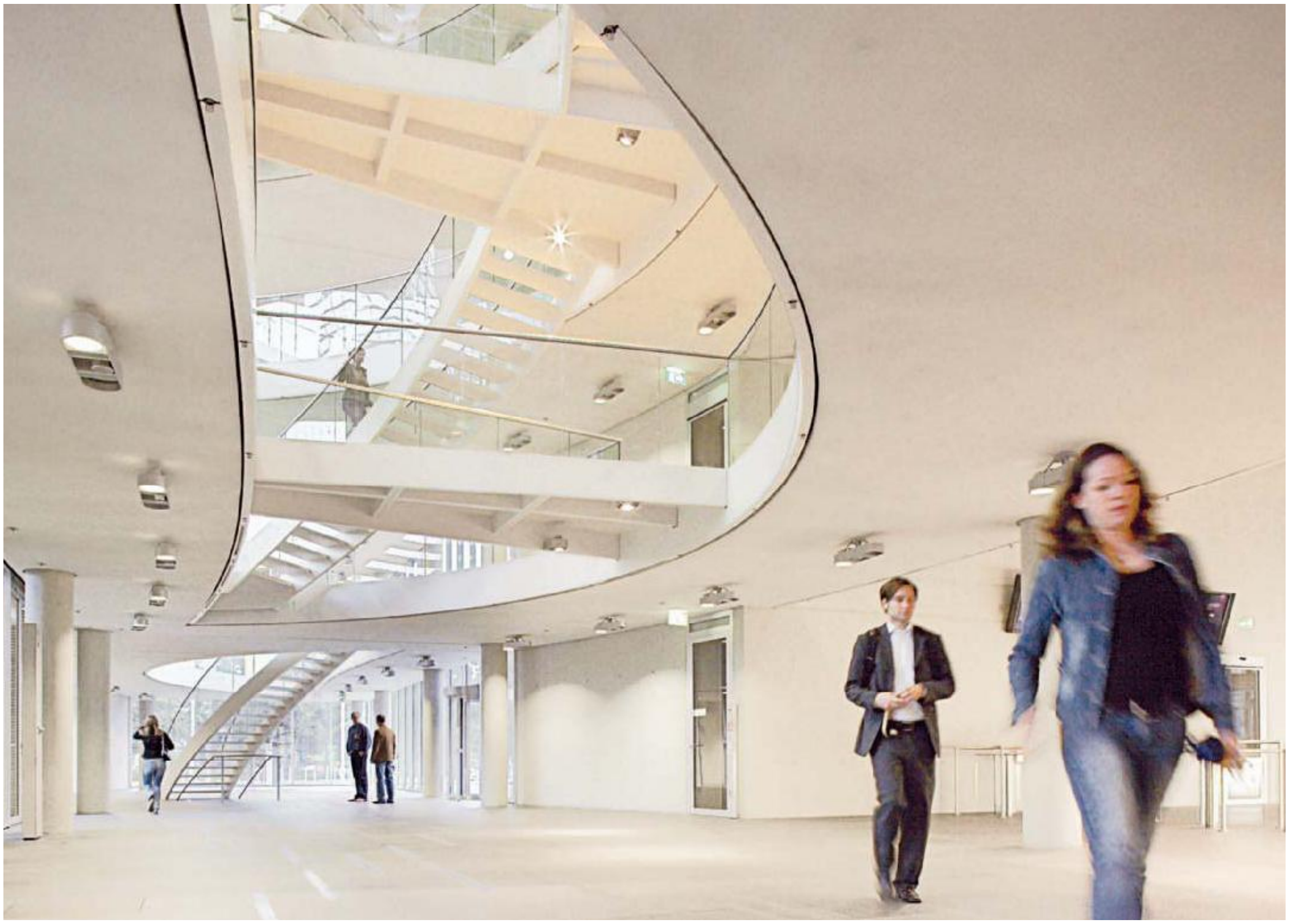
Collaborating on a low-energy, high-tech structure

Ingenhoven worked with engineer Werner Sobek to create a reinforced-concrete structure for the modular pavilions. Prestressed reinforced-concrete shells, 138 feet long and 11 inches thick, cover the office wings, while non-bending, welded, rectangular steel sections form barrel-vaulted shells for the atrium roofs. Tall, slender, reinforced-concrete columns in the corner atriums offer support without obstructing the view. At the juncture of the concrete and steel-grid roof vaults, airfoil elements help with ventilation and rainwater control. Engineer Klaus Daniels conceived the numerous climate-control elements throughout.

1. *Office module*
2. *Raised floor*
3. *Sunscreen*
4. *Perimeter heating and cooling*



OFFICE SECTION



An undulating central spine bifurcates the aviation center and is wide enough for crescent-shaped meeting places (above).

Crescent-shaped openings around curving open-riser stairs admit daylight and foster visual connection between levels.

specific work is part of the latest addition to this working environment of the future, which includes a collection of artworks put together by Max Hollein and Nikolaus Schaffhausen, both of whom are curators and museum directors.

Today, the airport is already operating at full capacity, and plans are afoot to build a third runway north of the highway that will enlarge the capacity of the airport from 53 million to 75 million passengers a year. The situation is politically intricate, but crucial for this unusual airport located only 20 minutes by car from Frankfurt's central business district. After the runway is built, a third terminal south of the current airfield, on the site of the former U.S. Rhein-Main airbase, will be constructed, enabling Lufthansa to enlarge its headquarters building.

Since Ingenhoven designed the modular office complex to allow for future additions, expansion could easily accommodate 4,500 people in the future. The building's slowly ascending profile as part of a bow-shaped crescent would find formal completion when a total length of more than 1,600 feet has been reached, three times the current 600-foot length. It will not only stand as a symbol for the paradigmatic change of office spaces in general, but will also be one of the largest sustainable work-space complexes placed at a very public traffic node. ■

For sources, see page 132.

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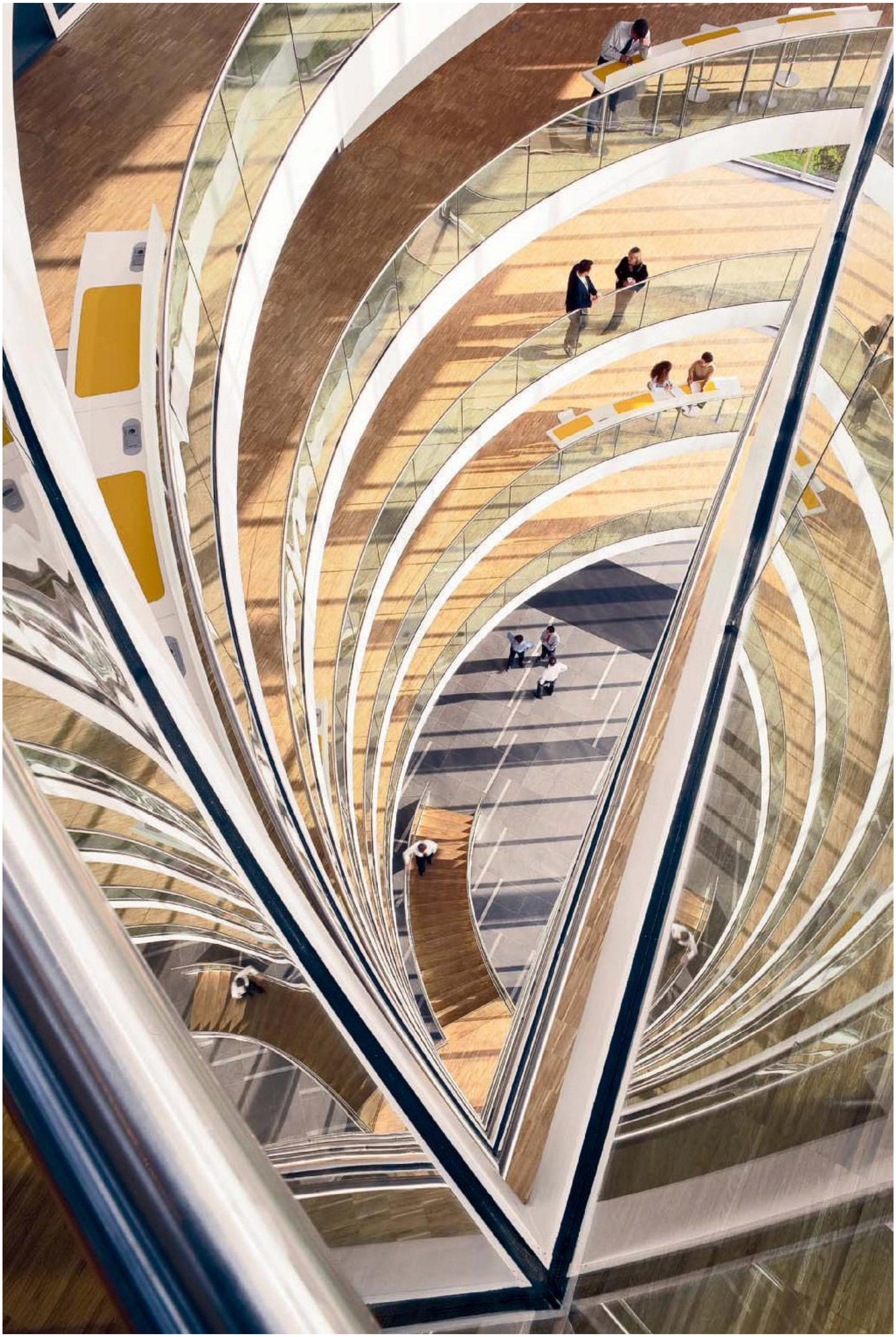
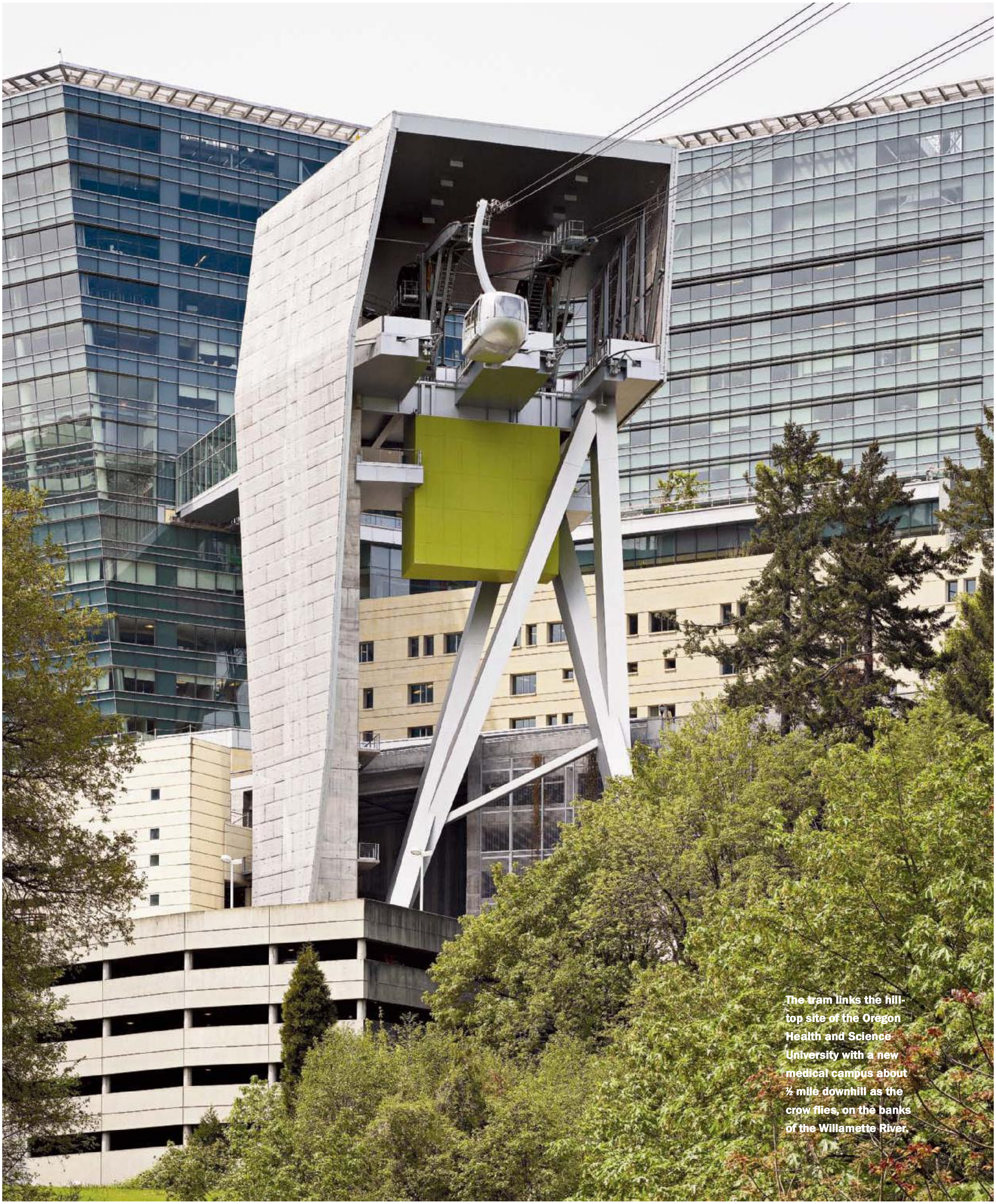
Submit your project to ***construction.com/community/gallerylist.aspx***.

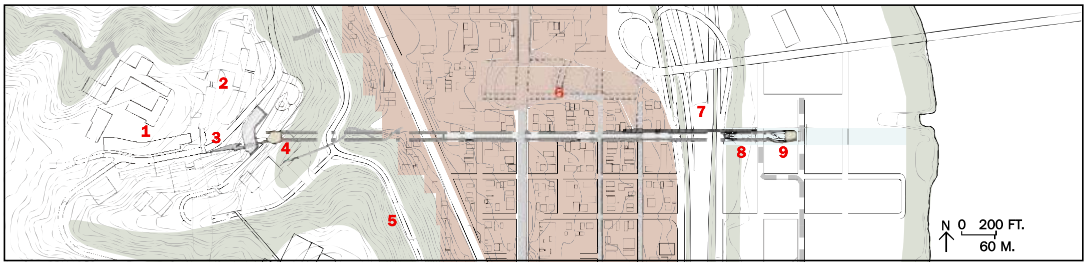
The positioning of the crescent-shaped openings with glass balustrades through the seven-story building creates a sculptural (if somewhat vertiginous) light well.





The tram links the hilltop site of the Oregon Health and Science University with a new medical campus about ½ mile downhill as the crow flies, on the banks of the Willamette River.

In Portland, AGPS Architecture and Arup tease drama out of the AERIAL TRAM, a landmark of engineering bravado



1. *Oregon Health and Science University*
2. *Marquam Hill*
3. *Tram entry*
4. *Upper station*
5. *Terwilliger Parkway*
6. *Corbett Terwilliger Lair Hill Neighborhood*
7. *Pedestrian bridge*
8. *Tram tower*
9. *Lower station*

In addition to connecting to the Oregon Health and Science University's hilltop campus at one end, the project became the centerpiece for a new high-density, mixed-use waterfront neighborhood at the downhill terminus of the tram.

PHOTOGRAPHY: © ERIC STAUDENMAIER

By Randy Gragg

Instead of landing on a mountainside and anchoring into bedrock, Portland, Oregon's new aerial tram soars between two 200-foot towers, representing Olympian engineering gymnastics. Similarly sized high-rise buildings, with no tram, might require a dozen load cases. By contrast, the Portland tram's structural engineers, Arup, calculated more than 2,000 separate cases for such structural feats as bracing the 165 million pounds of overturning moment caused by holding 1 million pounds of cars and cables in the air; the 20,000 tons of torque triggered by the tram cars passing one another; and the 80 tons of wind load carried by the cables stretching along the 3,300-foot route.

In addition to constructing sky bridges and buildings that span ravines, the hilltop Oregon Health and Science University added the aerial tram as its newest connecting structure. This gesture at once connected new related development at the bottom of the hill and addressed the tangled web of passageways that define every medical campus of a certain age, including this one. Given that the tram cars would fly over Portland's oldest national historic district, two parks, 13 streets, and eight freeway lanes, the architecture needed to be compelling. The developers, university, and city organized an international design competition, which the Los Angeles/Zurich firm Angelil/Graham/Pfenninger/Scholl (agps architecture) and Arup's Los Angeles office won over three other teams. Inspired by the work of celebrated Swiss timber engineer Julius Natterer, as well as the region's tradition of loggers' yarding poles, the agps/Arup team initially proposed towers made of high-tech wood laminates and mirror-finished tram cars shaped like bubbles.

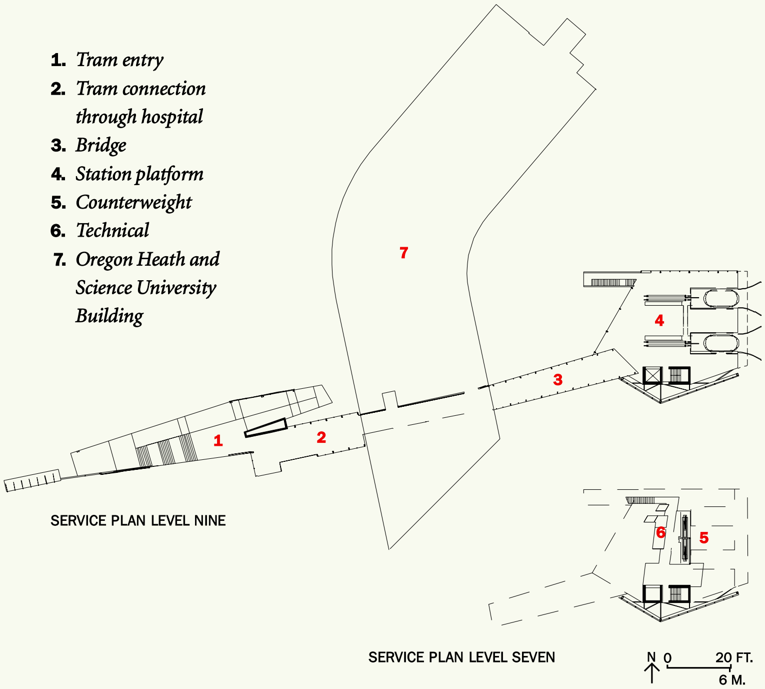
Reality quickly intruded. To fully integrate with the campus's so-called ninth floor—a single-level series of corridors and sky bridges connecting all of the hilly campus's patient-care and research facilities—the tram needed to land at a new hospital expansion already under construction. University officials worried the tram's 470-kilowatt motor turning an 8-foot "bullwheel" coupled with a 40-ton concrete counterweight constantly moving up and down would vibrate the hospital's microsurgery facilities. This led the engineering team to structurally separate the tram from the hospital. Thus, a freestanding tower had to serve as the upper station while holding 1 million pounds of tram cars and cables aloft.

The architect and engineers knew the loads would be extreme

Randy Gragg is the former architecture critic for The Oregonian. *He is the editor of a new shelter and city design magazine,* Portland Spaces, *making its debut in January.*

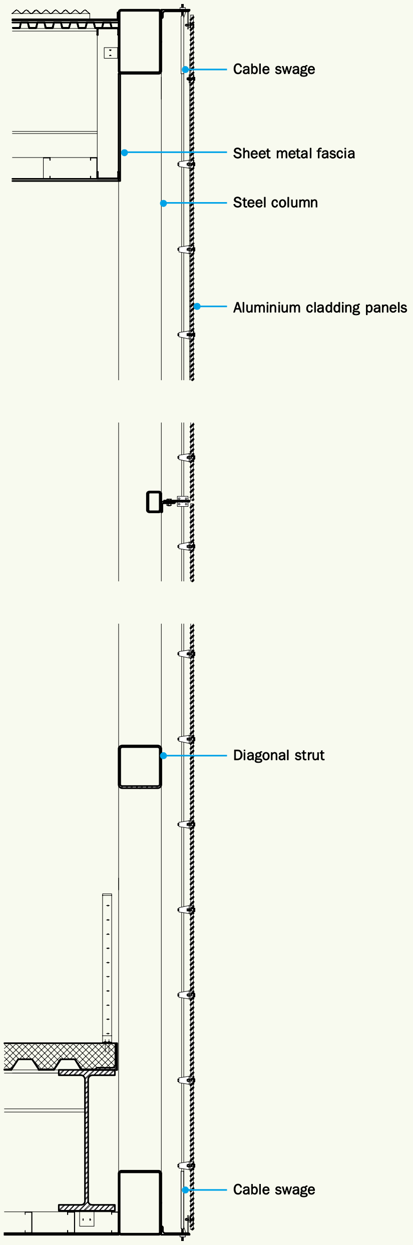
Project: *Portland Aerial Tram, Oregon*
Architect: *agps architecture—Sarah Graham, AIA, partner; Marc Angélil, Moshik Mah, Mark Motonaga, Joe Baldwin, Scott Utterstrom and Chet Callahan, project team*
Engineers: *Arup (structural, m/e/p); Dewhurst Macfarlane and Partners (facade engineering); Geo Design (geotechnical); W&H Pacific (civic)*
General contractor: *Kiewit Pacific Company*

1. *Tram entry*
2. *Tram connection through hospital*
3. *Bridge*
4. *Station platform*
5. *Counterweight*
6. *Technical*
7. *Oregon Heath and Science University Building*

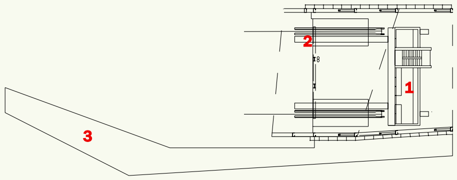

7
4
3
1
2
6
5
N
0
20 FT.
6 M.

SERVICE PLAN LEVEL NINE

SERVICE PLAN LEVEL SEVEN

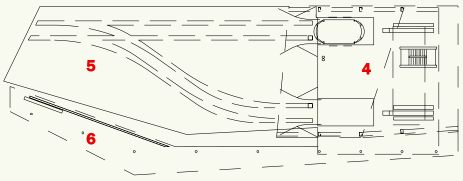

Cable swage
Sheet metal fascia
Steel column
Aluminium cladding panels
Diagonal strut
Cable swage

NORTH WALL SECTION

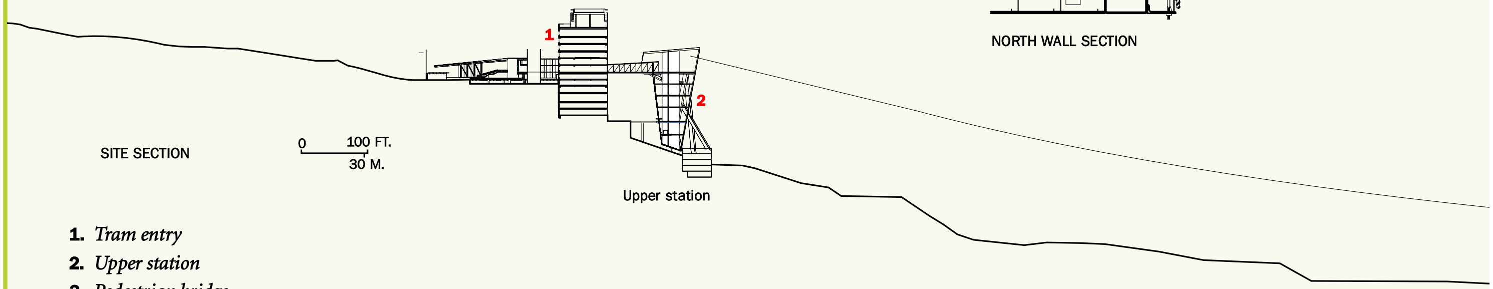


CONTROL ROOM PLAN LEVEL 2

1. *Control room*
2. *Tram saddles*
3. *Pedestrian roof*
4. *Station platform*
5. *Storm water basin*
6. *Bus bench and bike parking*



GROUND PLAN LEVEL 1


1
2
0
100 FT.
30 M.
Upper station

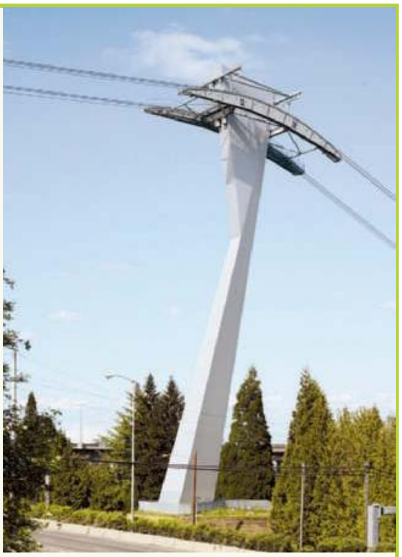
SITE SECTION

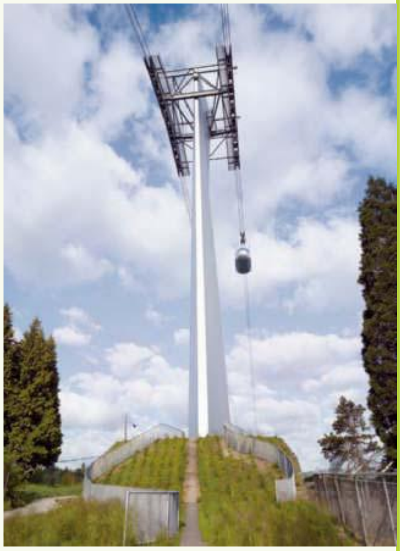
1. *Tram entry*
2. *Upper station*
3. *Pedestrian bridge*
4. *Tram tower*
5. *Lower station*

Minimal architecture to convey complex ideas

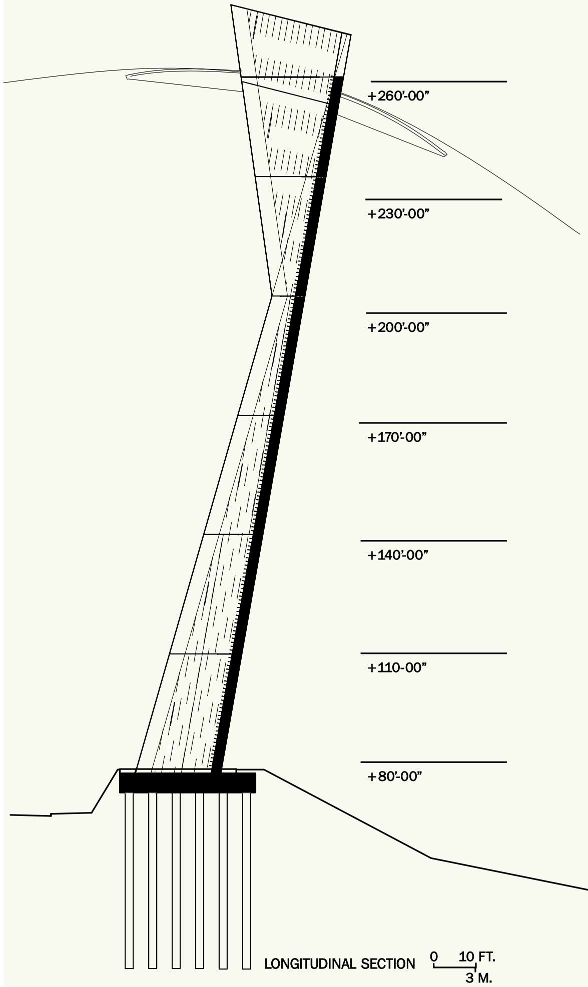
Sarah Graham, AIA, partner in charge: "As the idea for the tram was minimal infrastructure, the drawings intended to represent that idea in their language of reduction. We drew as few lines as possible, which translated into as few layers and materials as possible."

The section (far left) indicates the main weld joints of the tapering, 199-foot-tall intermediate tower. The plan cuts through the tower (left) indicate the twists it undertakes from its base to top. Precise full-penetration welds on the ⅝-inch plates were required to resist the massive dynamic loads of the tram cars.

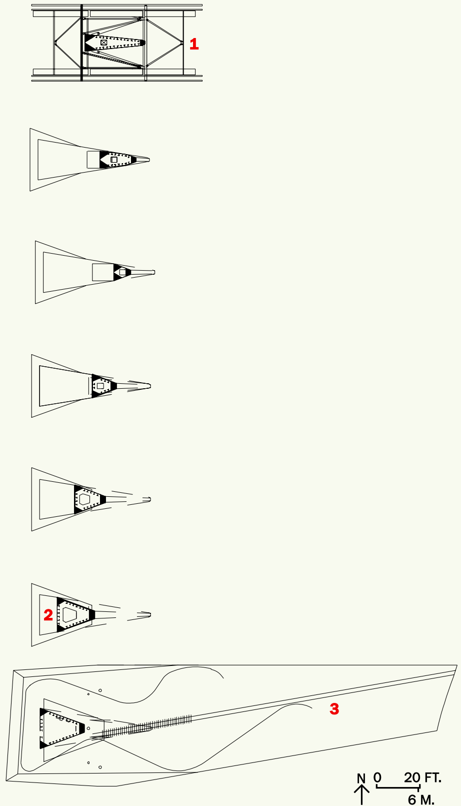




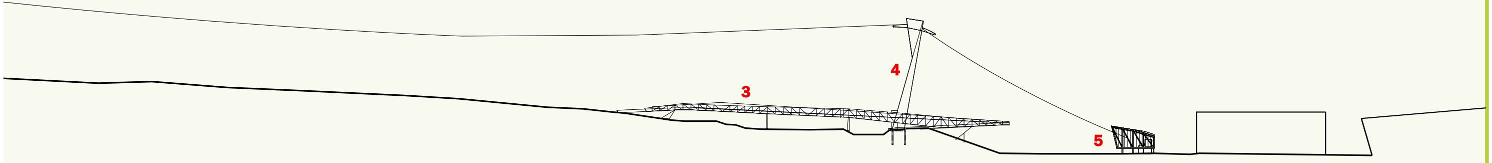
1. *Saddles*
2. *Landing*
3. *Landscape*



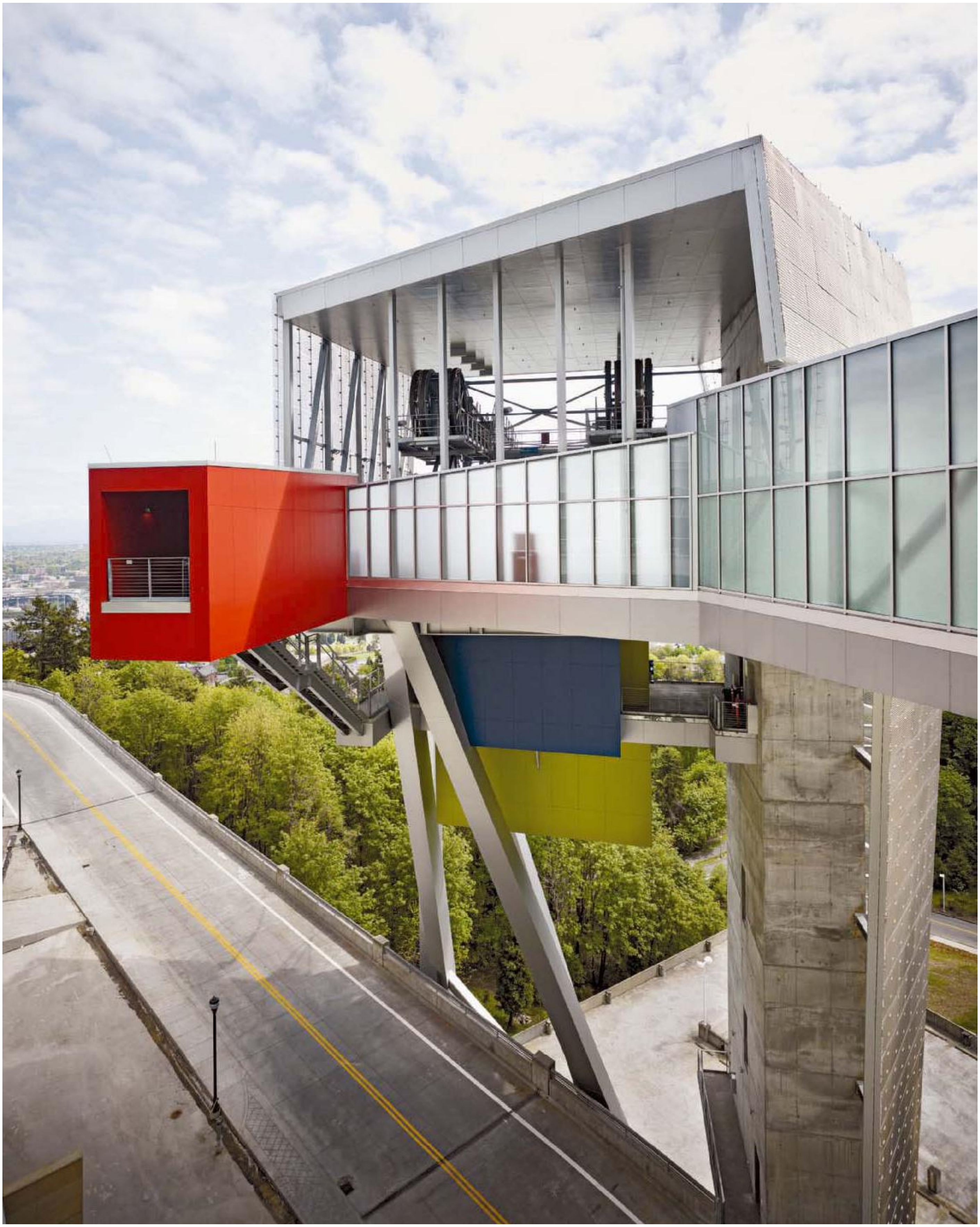
LONGITUDINAL SECTION

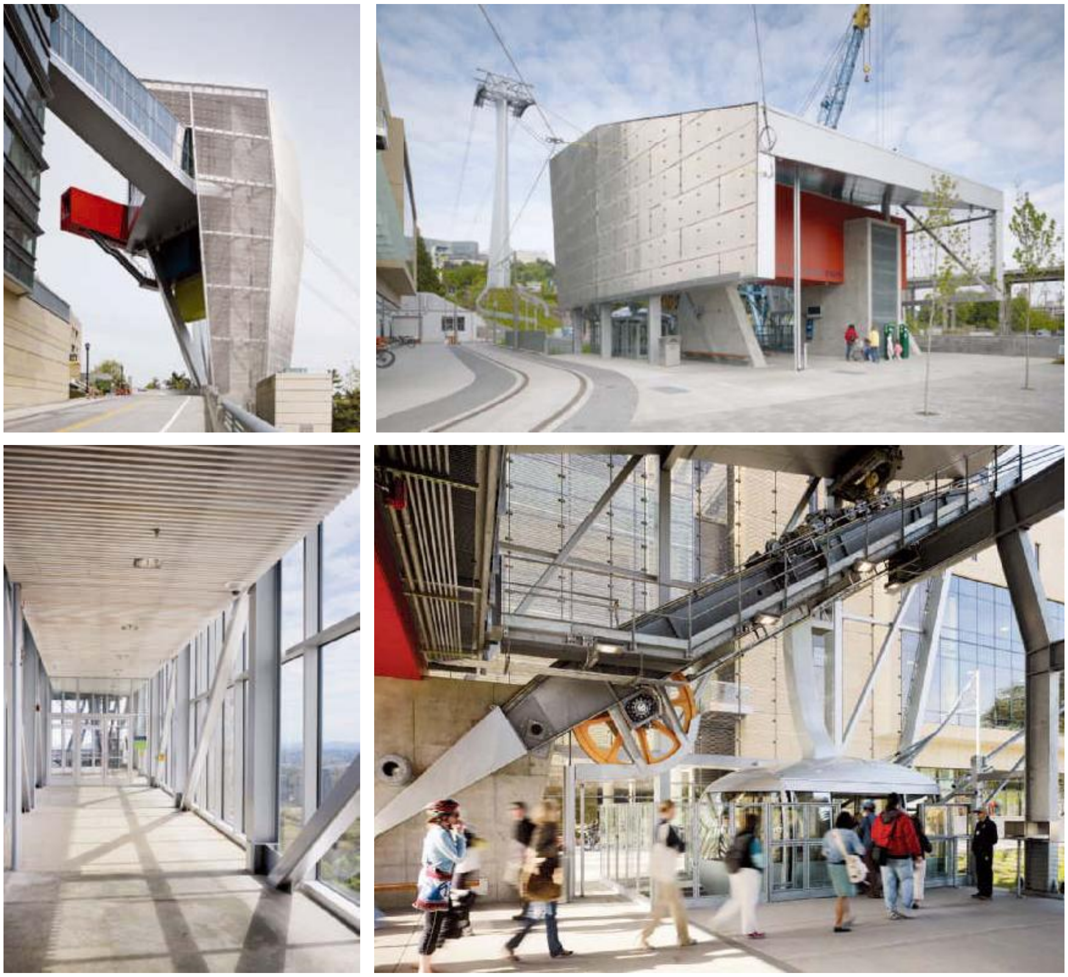


TOWER PLANS



Lower station





Tram elements include an upper station (top and bottom left and opposite); an intermediate support tower (top right, in the background); a lower station (top and bottom right); and two tram cars that operate in a jigback configuration. The upper station is an open-air covered platform supported by braced steel legs balancing on a steep site, wedged between hospital buildings. The lower station is an open platform at street level with a covered roof.

for a wood structure, but the team soon learned from the Austrian tram manufacturer Doppelmayr that the tolerances were unforgiving: 1½ inches maximum movement for the upper tower and ¾ inch for the intermediate tower. "It seemed at the far edge of the possible," recalls Sarah Graham, AIA, agps's partner in charge.

The team quickly abandoned wood for steel, but still hoped to retain the original concept's simplicity and lightness. Augmented by a combination concrete stair and elevator core, the upper tower's original criss-crossing pilotis proved adaptable to a simple scheme of two counter-braced A-frames made of four hollow legs fabricated out of 1-inch plate steel, all anchored in a single 10-foot-thick piling cap.

The intermediate tower's need for tortional stability, however, proved tougher to solve. For the design competition, the team imagined a single, cable-stayed pole. The team tried dozens of multilegged schemes, but each lacked either the necessary rigidity or the elegance required of a future city icon. "On any project with architecture with a capital *A*," points out structural engineer Steve Ratchye, then of Arup, now with Thornton Tomasetti, "you try many things that lead to a lot of dead ends." Graham finally switched her strategy, she says, to "working the forces" with hollow steel—a single, tapering, bending, hollow tower sculpted out of ¾-inch steel plates. Though it soars upward with the grace of a Brancusi bird, the tower is all business: The 10 percent vertical tilt better counters the cable loads and the carefully welded, tapering, trapezoidal cross section calms wind vibrations in a manner known as "vortex shedding."

Graham describes the tram's design as "all engineering." That made the aesthetic discoveries—and debates—all the more fun, in Graham's words. Budget cuts, for instance, nixed photovoltaic cells, glass, and polycarbonate for the tram stations' windscreens. So, working with facade engineering specialists Dewhurst MacFarlane and Partners of New York, Graham switched to the coarsest available expanded-aluminum mesh. This first-ever application of the material as cladding required extensive wind testing. The result blankets the muscular, no-nonsense docks in ethereal shadows and shimmering moiré patterns.

The widest departures from the arduous form-follows-engineering design are the tram cars. Budget required the team to use Doppelmayr's stock, safety-code-approved frame design. But for the outer skin, Doppelmayr brought two former Bugatti sportscar craftsmen out of retirement to hand-hammer a curvilinear shape. The result isn't the otherworldly bubbles that agps/Arup first proposed. It's better: a simple, classic design that adds just the right flourish to the poetic minimalism of this unprecedented transportation project. ■

For sources, see page 132.

ONLINE: To rate this project, go to ***architecturalrecord.com/projects/***.
Submit your project to ***construction.com/community/gallerylist.aspx***.

SOURCES/RESOURCES PROJECTS

U.S. FEDERAL BUILDING

San Francisco

(page 96)

Sources

Curtain wall: *Permasteelisa Cladding Technologies (aluminum); T&M Manufacturing/Permasteelisa (perforated-steel panels)*

Glazing: *Viracon (exterior); Old Castle (interior)*

Paneling: *Swisspearl (fiber-reinforced cement); 9-Wood (perforated maple)*

Surfacing: *Perfect Polish (concrete floors); Ecofloor (rubberized); Armstrong World Industries (linoleum)*

Cabinetwork: *ISEC*

Roofing: *Tremco*

Lighting: *Zumtobel (pendants, downlights); Lighting Services (lantern fixtures); Arrow (neon artwork)*

Paints: *Tiger Drylac Powdercoating (interior stair and guardrails); ICI (wall paints)*

Office furniture: *Herman Miller*

Wall coverings: *Impact Imaging (custom-printed panels)*

Ceilings: *Armstrong World Industries (acoustical panels, suspension grid)*

Carpet: *Interface*

Conveyance: *Mid-American Elevator*

SUVARNABHUMI AIRPORT

Bangkok

(page 122)

Sources

Curtain wall: *Permasteelisa/KAMA*

Concrete: *Ritta; Italian-Thai Development*

Roofing: *B&O Hightex (fabric membrane)*

Glazing: *Viracon; Thai-German Specialty Glass (glass); Chadwick Airport Consortium (skylights)*

Doors: *NABCO (entrances); Ceco (metal doors)*

Hardware: *Schlage*

Interior finishes: *CCM Airport Equipment (casework, signage); TOA-Chugoku (paints, stains)*

Flooring: *Marblex (Terrazzo tile); Lindner (raised flooring)*

Fixed seating: *Akaba*

Conveyance: *KONE (elevators); Mitsubishi (escalators); Hitachi (moving walkways)*

Baggage handling system: *Kawasaki*

Stainless steel: *Thapanin (planks and stairs)*

LUFTHANSA AVIATION CENTER

Frankfurt

(page 108)

Sources

Curtain wall: *Josef Gartner*

Metal lining: *Schmid (ceiling)*

Furniture: *Vitra*

Lighting: *ERCO Leuchten*

Technology: *Gira Giersiepen (room-specific control units)*

Washbasins: *Pfeiffer & Söhne*

Grips/fittings: *Franz Schneider Brakel*

PORTLAND AERIAL TRAM

Portland

(page 116)

Sources

Exterior coating: *Wasser; Tnemec*

Exterior cladding: *James Hardi (concrete fiber board); Dramex (aluminum panels); AIG (aluminum fastening)*

Elevator: *Schindler Elevators*

Waterproofing: *American Hydrotech*

Paint: *Sherwin Williams*

Glass: *Oldcastle Glass*

Storefront system: *Kawneer*

Louvers: *United Enertech*

Light fixtures: *Bega; Omeaglux; Prudential; Lithonia*

Flood barrier: *Presray*

Gypsum sheathing: *GP*

Structural steel fabrication: *Thompson Metal Fabrications*

For more information on these projects, go to Projects at **architecturalrecord.com**.

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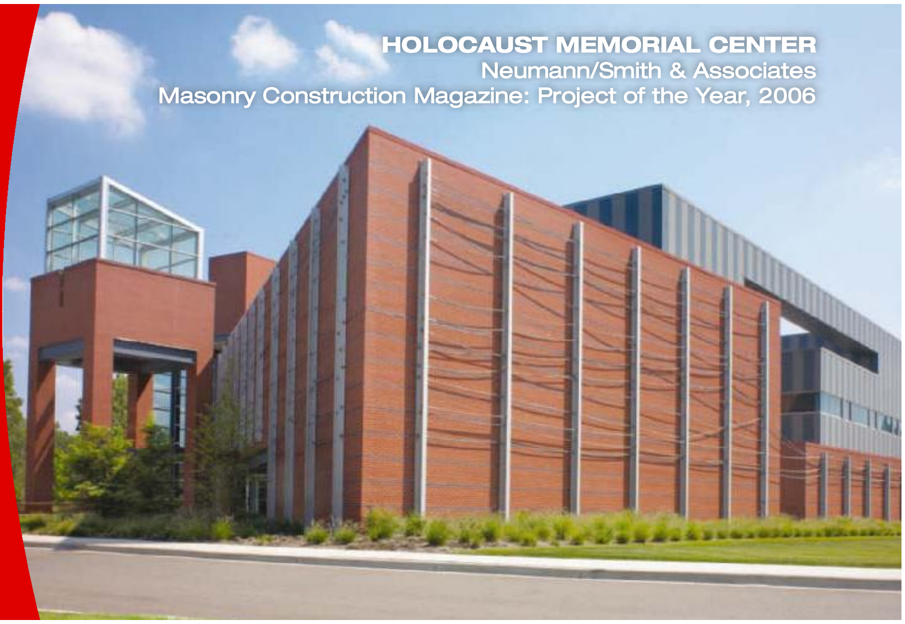

HOLOCAUST MEMORIAL CENTER
Neumann/Smith & Associates
Masonry Construction Magazine: Project of the Year, 2006

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WHA Architecture & Planning PC
Brick in Home Building: Best in Class - Multi-Family Design

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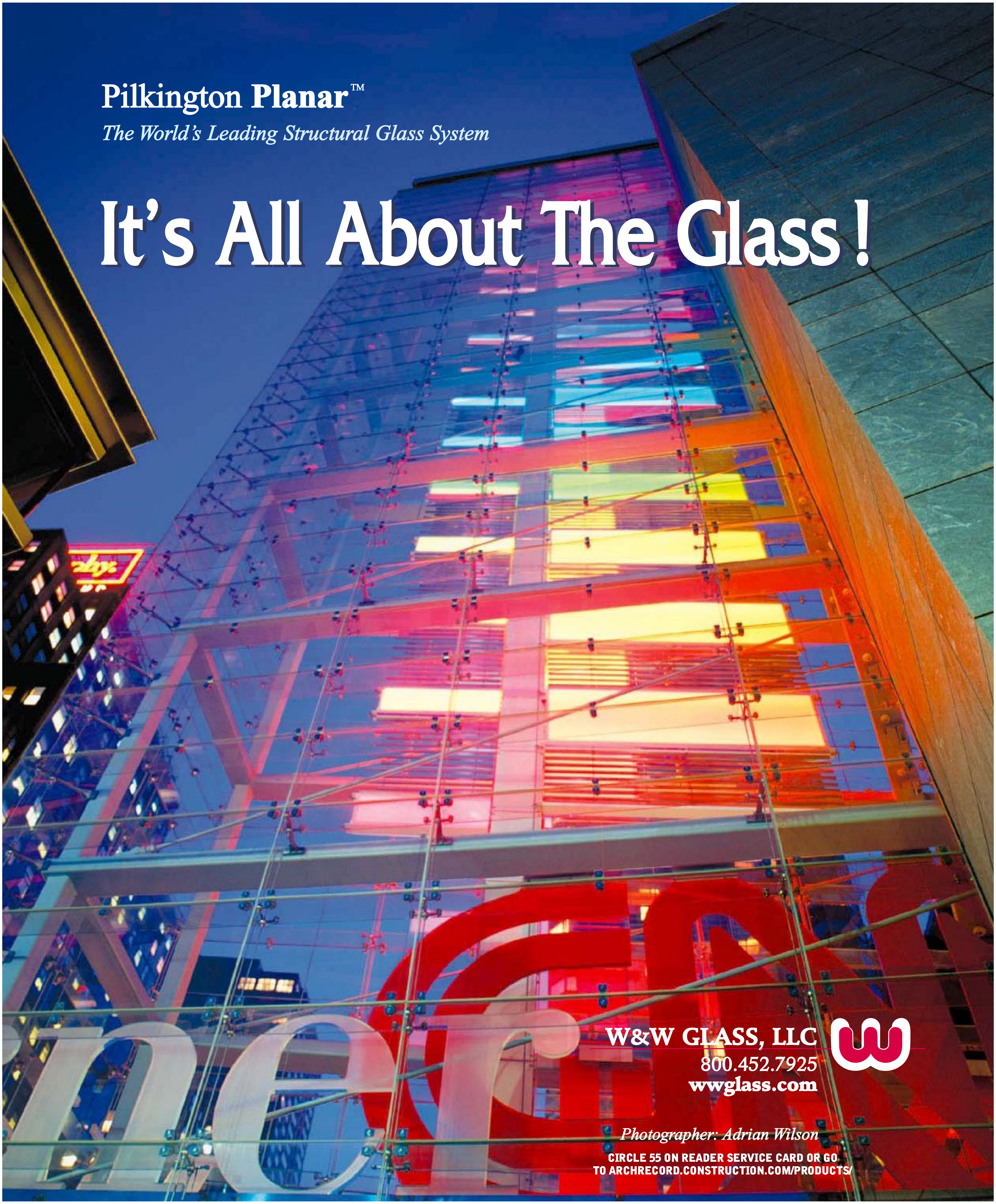

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TALL BUILDINGS

Topped/Tapped Out

“If you had to cut costs, why didn’t you cut floors instead of corners?” —Paul Newman, as architect Doug Roberts in The *Towering Inferno.*

By Russell Fortmeyer

The skyscraper has had more comebacks than Cher. From its humble, naive beginnings in Chicago after the fire of 1871; its idealistic representation in early European Modernism; its apex as the glam symbol of American corporate eminence; its bimbo phase in Postmodernism; its more recent dalliance with high-tech engineering; and culminating with its supposed demise on September 11, 2001, the skyscraper is one helluva contender.

Every time we think we’ve solved the typology, realized its total fulfillment, and built the freshest example, the skyscraper struts out in yet another tectonic version of a Bob Mackie gown—dripping in sequins, devoid of meaning, pure fabulousness. And we can’t turn away.

“The industry is able to build these unusual forms, but we haven’t got our minds around what that means,” says David Scott, a structural engineer in Arup’s New York office and the current chair of the Council on Tall Buildings and Urban Habitat. “People are being too flippant.” Scott worries that although tall buildings can address rapid global urbanization, enough architects and engineers aren’t considering the attendant environmental context in terms of ecological impact. Too often, he says, architects apply sustainable concepts to the existing skyscraper typology, without questioning the typology itself.

Enter the dazzle. We are awash in new skyscrapers, but the typology’s reenergized career banks on one of two design strategies: go really tall or technologically dazzle. Think of it as choosing between Gothic and Baroque, minus the cultural baggage. We can always go tall, though how tall remains an open question. Dazzle is much harder to locate—be it techno gimmickry, stylistic parlor tricks, or a trendy patina of sustainability. The proposals for the World Trade Center (WTC) site were one long, dazzling

7 WORLD TRADE CENTER

New York, New York

In a dry run for its forthcoming Freedom Tower, Skidmore, Owings & Merrill design a jewel-like tall building that is already rewriting the book on safety.

SPORTS CITY TOWER

Doha, Qatar, United Arab Emirates

AREP and Hadi Simaan bestow an instant icon on a rapidly developing city, bolstering civic pride during the Asian Games.

MONTEVIDEO TOWER

Rotterdam, the Netherlands

The exterior cladding on Mecanoo’s multifaceted residential tower shifts materials to indicate a variety of dwelling situations for a new building on a revitalized postindustrial pier.

FXFOWLE’s India Tower will include many sustainable features.

PHOTOGRAPHY: © RUGGERO VANNI (TOP); COURTESY AREP (MIDDLE); © CHRISTIAN RICHTERS (BOTTOM); COURTESY FXFOWLE (RIGHT)

audition after another for a comeback tour that never happened. Regardless, at any given moment, we can find a skyscraper (or two) to step forward as the repository of our collective wish fulfillment: the Burj Dubai and Beijing's CCTV Tower.

Structural engineer Bill Baker in the Chicago office of Skidmore, Owings & Merrill (SOM) claims the Burj will be the tallest building in the world once completed in 2008 (around 160 floors rising over 2,600 feet). And Arup's Cecil Balmond, the lead structural engineer on Rem Koolhaas's and the Office for Metropolitan Architecture's CCTV, also to be completed in 2008, has called that building the most structurally complicated he's ever designed. Tall or dazzling, both towers are icon-making tools, visual propaganda for political states in the throes of expansion. Be careful what you wish for.

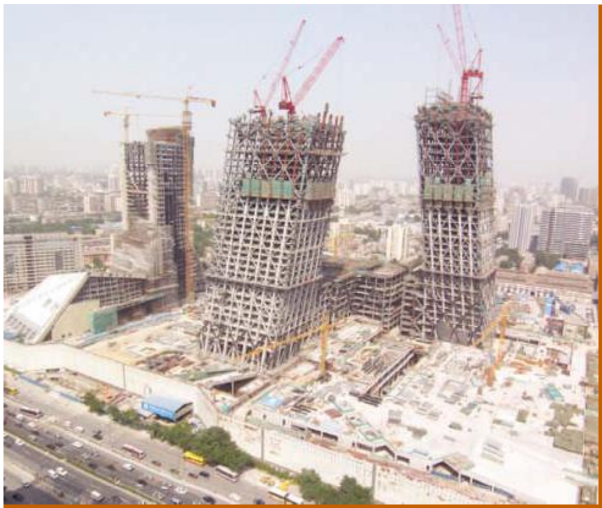
The Burj and CCTV also willfully rebuke America's assumptions of skyscraper preeminence, despite the fact that both projects—like so many others today—represent global design teams with significant American contributions. The computer doesn't care where you are, and so-called building information models (BIM), heartily embraced by firms such as SOM, Arup, KPF, Buro Happold, and FXFOWLE, promise to further simplify and concretize the collaborative design process. But that is a problem internal to architecture and engineering, entirely solvable through the market (just ask Autodesk and Bentley), whereas getting the tall or dazzling project built remains at the mercy of so many bureaucrats and businessmen.

Market and regulatory demands have become so perilous for skyscraper interests in the States—epitomized by the flawed process at the WTC site—that many domestic observers and fans of the typology have given up expecting anything more than mediocrity, or what we could start calling the "Miami Effect." Hence, the media has a tendency to skirt past the tiny subject of democracy—not to mention safe job-site conditions and fair employment regulations—when raving about the "just-get-it-done" spectacles of Dubai, Abu Dhabi, Shanghai, Beijing, and so on. Conversely, if architecture needs Communism to realize a project like CCTV, what exactly did it require to accomplish what we are developing at Ground Zero?

Many eyes will stay trained on SOM's developing Pearl River Tower in Guangzhou, China, the first "net" zero-carbon skyscraper designed to produce its own energy. The project represents the kind of optimism (and PR maneuver) that used to define American skyscrapers—neither the firm's Burj nor its Freedom Tower at the WTC can compare to the performance-based innovations planned for Pearl River. There are still many in the design world, however, who doubt the project, since true building performance remains somewhat of a guessing game, especially for skyscrapers. It's telling that there are few, perhaps less than a dozen, proposed tall buildings in the world designed with the strategies of Pearl River. When there is no precedent, clients get nervous.

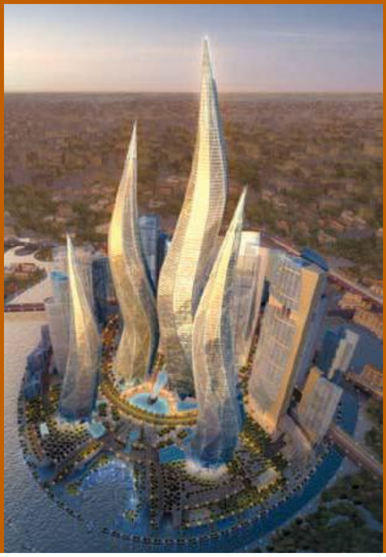
These unresolved issues still linger in the rush to develop a new urban world, where the United Nations estimated in June that more than half the world's population now lives in cities. Given the recent building boom, critics and theorists have written relatively little on the skyscraper, especially outside of the contexts of the WTC and such places as Dubai or Guangzhou. No wonder Koolhaas's *Delirious New York*, which turns 30 years old next year, still reigns as provocative reading in architecture schools. Even Koolhaas builds more than he writes today—and some of his more recent proposals for skyscrapers, like that in Jersey City, certainly don't inspire confidence. In 2002, Ken Yeang published his *Reinventing the Skyscraper, A Vertical Theory of Urban Design*, which lays down a fairly ambitious model of the skyscraper as an environmentally responsible ecosystem, a nonhomogenous collection of programmed and vegetated spaces that theoretically approximates the functions of a city for a globally connected Internet culture. Yeang's writing and conceptual designs have appeal, especially among the green set, but like Koolhaas, the ratio of finished project to unbuilt proposal remains too low to gauge its effects outside of vanity projects. This is, after all, still serious architecture, with

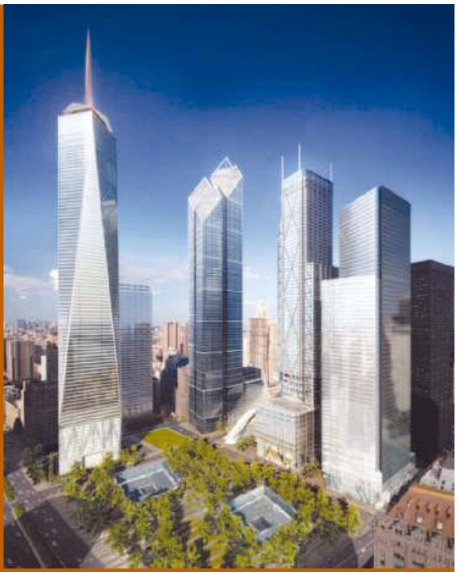
PHOTOGRAPHY: COURTESY OMA/REM KOOLHAAS AND OLE SCHEEREN (LEFT); TVSA (MIDDLE); SILVERSTEIN PROPERTIES (RIGHT)



The Office for Metropolitan Architecture's CCTV Tower (above), designed with Arup, lies at the forefront of structural innovation for the skyscraper.

The four towers of TVS & Associates' proposed Dubai Towers (below) will anchor the Lagoons development. The largest tower tops out at 97 floors.





The proposed development at the World Trade Center site in New York (above, from left to right): SOM's Freedom Tower and towers by Norman Foster, Richard Rogers, and Fumihiko Maki.

a capital *A*, not your everyday Shanghai business park. As Yeang said at a recent lecture in New York, "Low-energy design is a lifestyle issue." And not everyone can afford lifestyle.

While we don't lack a multitude of pretender firms to the skyscraper throne of invention, Koolhaas and Yeang remain, for better or worse, among the more credible voices. Koolhaas's CCTV elegantly achieves the programmatic complexity of which Yeang writes, while avoiding the ecological dress (i.e., hanging gardens, sky terraces) and multiple structural systems as proof-of-concept of Yeang's proposed Elephant and Castle Eco-Towers in London. But both architects participate in the cult of the skyscraper with us since early Modernism, granting the typology significance in urban design that it will never wholly realize (Koolhaas does it ironically, knowing the type is dead; Yeang believes his storyline). We used to call this sort of architecture utopian—we put our faith in the unrealizable dream of the skyscraper—but anyone getting caught up in this or that new skyscraper today is at best ignorant, or at worst, in denial.

Critic Cynthia Davidson, in the Spring 2004 issue of *Log*, laments the vacuum of ideas for the skyscraper, referring to 1920s and 1930s New York as evoked in Koolhaas's book as a lost moment before the tall building became a power symbol motivated solely by economics. Is it any surprise that the critical fallout of the disaster of September 11 turns out not to be the demise of the skyscraper, but the revelation of its continued cultural, social, and political value? This is especially true for cities in developing economies.

So, if the reduced form of any skyscraper merely amounts to a symbol of power—whether tall or dazzling—the discussion must then shift to the consideration of who creates or, more important, who pays for the creation of these private/civic symbols—who is, in Davidson's terms, projecting their "power"? This is the lesson of the WTC, in that it exposed, as much as humanly possible given the political circumstances, the machinations that fuel real estate speculation (and its pet, architecture) in today's economy—the private, public, and global forces that act with little concern for the micro-local effects or even the strain on regional infrastructure.

We have always had a tendency to congratulate corporations, or the interests that control them, for building extraordinary skyscrapers, somehow identifying our beliefs in progress and economic success in their appearance on our skylines. The failure of imagination that has stymied the WTC and the politics plaguing other megasites—such as the twin Frank Gehry projects of Atlantic Yards in Brooklyn or Grand Avenue in Los Angeles—have only temporarily obscured the fact that we remain enamored of skyscrapers. So much so, we have been breathlessly converting obsolete models into residential use in nearly every American city.

Our selective memory enables us to overlook the relatively quick obsolescence of earlier skyscrapers, since so much of what tall buildings represent gets bound up in our desire to see them as continually new and built upon a typological tradition of impressive design vanguard. Could we consider that eventually even Renzo Piano's New York Times tower will be converted to live/work lofts, that its super-modern sustainable features, open floor plates, and bizarre ceramic-rod shading devices will come to be seen as untenable in a shifting commercial economic landscape? That architecture (and its media) masks this question in everyday practice suggests that the imminent answer will surprise many of us.

For now, we consider three contemporary examples of how the skyscraper can dazzle. SOM's impeccable, if straightforward, 7 World Trade Center, with its masterful play of light and transparency, is the first structure to rise on the site of the September 11 disaster. Mecanoo's Montevideo Tower, in Rotterdam, anchors a waterfront revitalization with a vertical mass broken by differentiated curtain-wall finishes, setbacks, and dizzying cantilevers. AREP's Sports City Tower, in Doha, Qatar, updates the observation tower with some added programmatic complexity hiding behind a steel structural wrapping. If none of these projects are quite the skyscraper's comeback, they steadfastly deliver as an opening act. ■

PHOTOGRAPHY: COURTESY SANTIAGO CALATRAVA (LEFT); ARQUITECTONICA (MIDDLE); SOM/STEINKAMP-BALLOGG PHOTOGRAPHY (RIGHT)

At 2,000 feet, Santiago Calatrava's proposed Chicago Spire (below) would be the tallest building in the United States.

Arquitectonica's Lulu Island tower (above) will anchor one of the largest developments on an artificial island off of Abu Dhabi.

SOM's Burj Dubai (below), at more than 2,600 feet, will be the tallest building in the world. Other developers plan to go taller yet, though those projects remain a secret.

One: 7 WORLD TRADE CENTER

New York City

Skidmore, Owings & Merrill have dropped a 1.7-million-square-foot hint for the buildings we can expect at a renewed World Trade Center.

By Russell Fortmeyer

Architect: *Skidmore, Owings & Merrill—David Childs, FAIA, design partner; T.J. Gottesdiener, FAIA, managing partner; Carl Galioto, AIA, technical partner; Ken Lewis, project manager; Peter Ruggiero, AIA, senior designer; Christopher Cooper, AIA, senior designer; Nicholas Holt, AIA, senior technical coordinator*

Client: *Silverstein Properties*

Consultants: *WSP Cantor Seinuk (structural); Jaros Baum & Bolles (m/e/p, vertical transportation, sustainability); Philip Habib & Associates (civil); Ken Smith Landscape Architects; Cline Bettridge Bernstein Lighting Design; Cerami & Associates (acoustics); Pentagram (signage); Mueser Rutledge Consulting Engineers (geotechnical); Ducibella Venter & Santore (security); James Carpenter Design Associates (artist); Jenny Holzer (artist)*

Construction manager: *Tishman Construction Corporation*

Size: *1.7 million square feet*

Cost: *Withheld*

Completion date: *May 2006*

Sources

Glass: *Viracon*

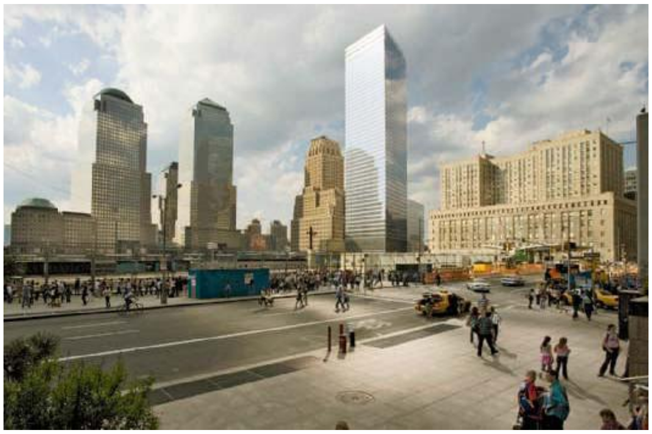
Screen wall LEDs: *LED Effects*

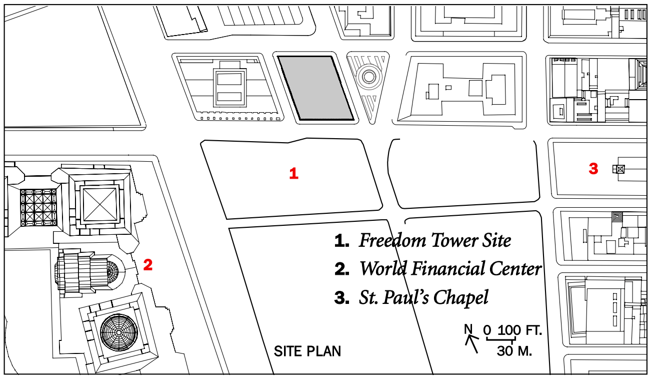
Tower crown lighting: *Kim Lighting*

ONLINE: Rate this project and access additional sources at **architecturalrecord.com/bts/**.

There has been so much written on what should, could, or would be built at the site of New York's devastated World Trade Center, the bound copies might likely fill the only tower that has actually been constructed: Skidmore, Owings & Merrill's 7 World Trade Center, or 7 WTC.

Not since the rebuilding in the 1990s of Berlin's Potsdamer Platz has there been a comparable undertaking in architecture: What do you build on a ruined site that occupies such a special place in the political, national, and cultural imagination of a people? If you're David Childs, FAIA—perhaps SOM's best-known design architect of the moment—you begin by building a 52-story skyscraper as a test, of sorts, of technology, aesthetics, collaboration—and will—before embarking on the adjacent 102-story Freedom Tower currently under construction.



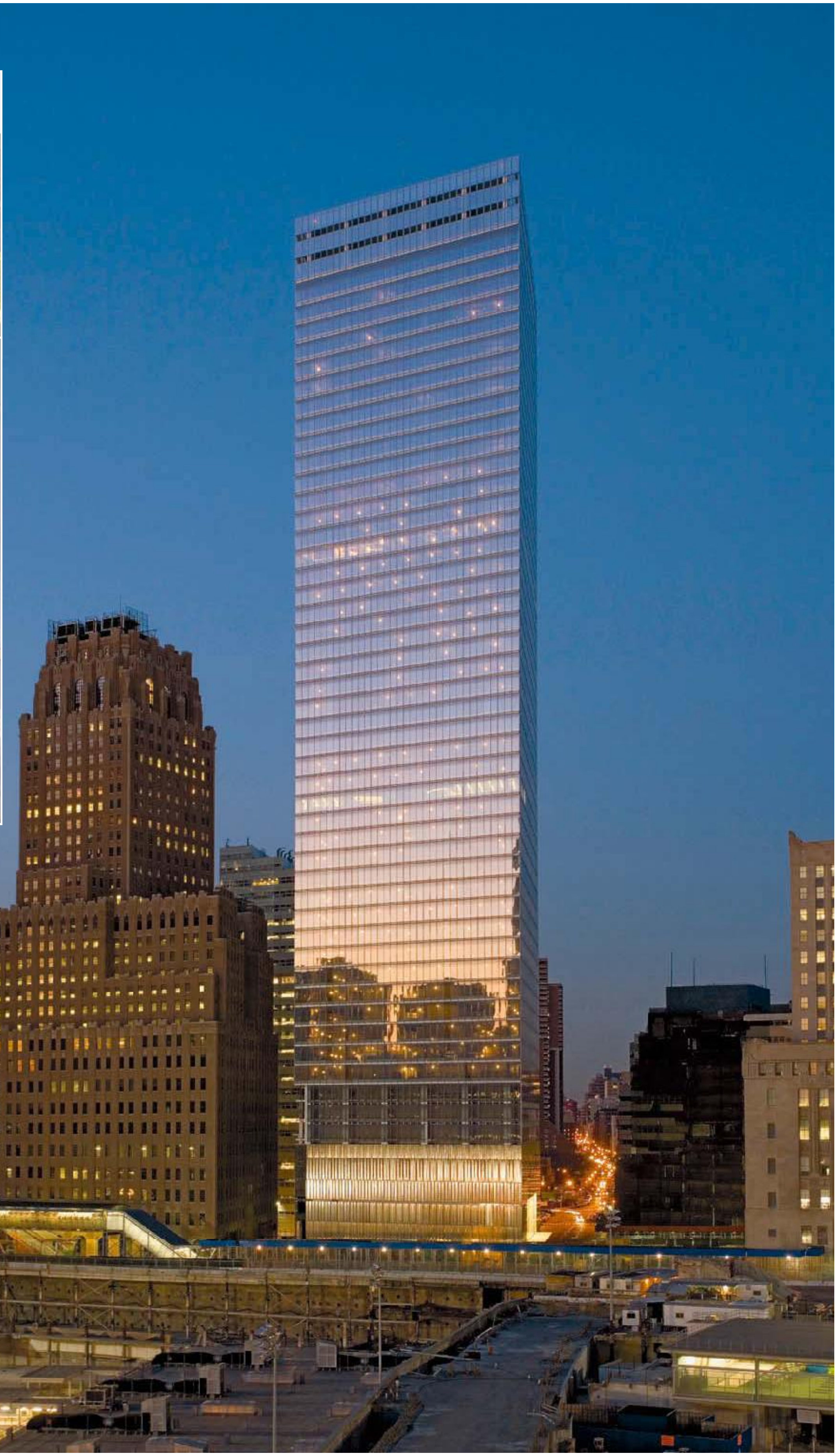


Program

If you've opened a newspaper in the past six years, you know that Larry Silverstein is the developer of the WTC site, having leased the property from the Port Authority of New York and New Jersey weeks before 9/11. But his involvement in the site predates this. In 1987, Silverstein built the original 7 WTC, designed by Emery Roth & Sons, on top of a 1967 Con Edison substation serving Lower Manhattan, but you would never have known that, since the original tower connected directly to the WTC's elevated podium. Almost immediately after the September 11 disaster—in which the existing 7 WTC was left unoccupied, to burn and collapse, while emergency personnel focused on saving lives—Silverstein brought the original building's design team together with a new architect, SOM, to rethink the site so Con Ed could rebuild the substation.

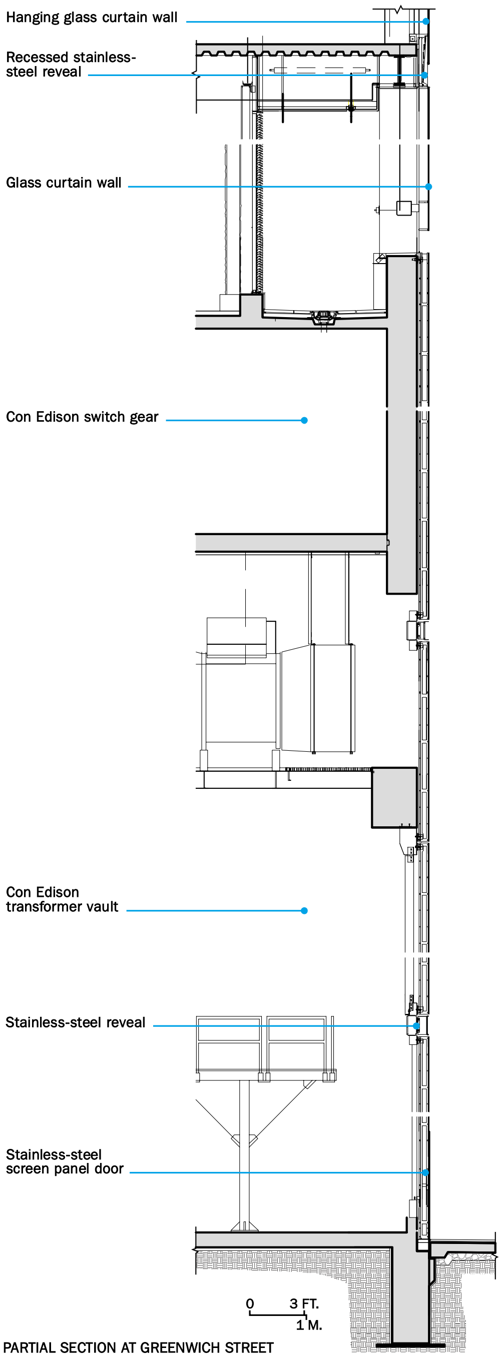
Childs says he quickly realized the project could reconnect Lower Manhattan and the WTC site north to the city by opening up Greenwich Street, which the original 7 WTC had blocked. "It was important visually, urbanistically, and historically to put that line back, since Greenwich is the original edge of the Hudson River,"

PHOTOGRAPHY: © RUGGERO VANNI; DAVID SUNDBERG/ESTO (OPPOSITE, LEFT TWO); CHUCK CHOI (OPPOSITE, RIGHT)

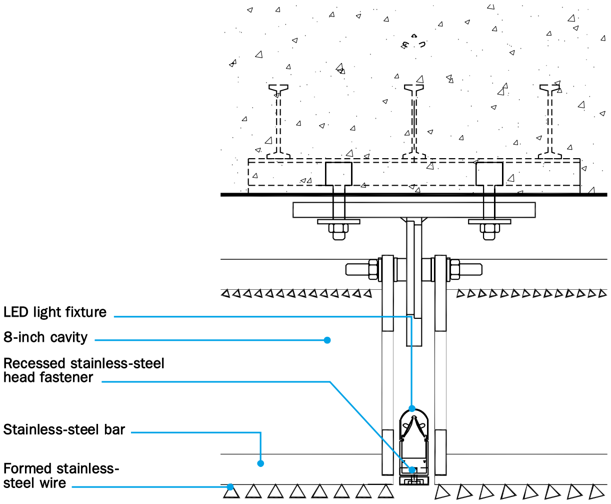


At 741 feet high, 7 WTC currently dominates the WTC site (opposite, top). The building's parallelogram footprint, on the site's western half, allows views north along Greenwich Street (right). At night, a programmed display of blue and white LEDs turns the base into a shifting, luminous surface (above). Varying stainless-steel wires (top) create daytime moiré patterns.

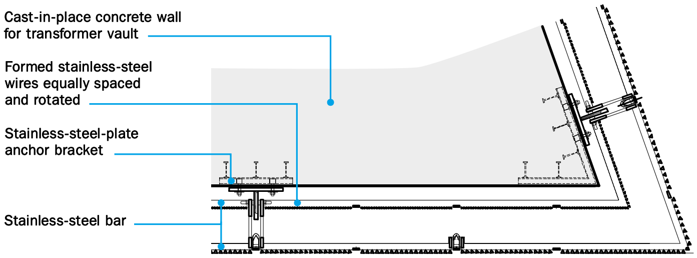
James Carpenter, the artist who collaborated with SOM to design the curtain walls (left), says the base was fabricated by a mining-engineering company that managed to keep costs down. The outer band of wires are 50 percent open, which allows for many visual effects. The Ken Smith–designed plaza (below right) includes benches, sweetgum trees, and space for rotating art installations, such as Jeff Koons's *Balloon Flower*, from Silverstein's collection.


Hanging glass curtain wall
Recessed stainless-steel reveal
Glass curtain wall
Con Edison switch gear
Con Edison transformer vault
Stainless-steel reveal
Stainless-steel screen panel door
0
3 FT.
1 M.

PARTIAL SECTION AT GREENWICH STREET


LED light fixture
8-inch cavity
Recessed stainless-steel head fastener
Stainless-steel bar
Formed stainless-steel wire

DETAIL AT PODIUM WALL WIRES


Cast-in-place concrete wall for transformer vault
Formed stainless-steel wires equally spaced and rotated
Stainless-steel-plate anchor bracket
Stainless-steel bar

ACUTE CORNER DETAIL AT EXTERIOR PODIUM WALL

PHOTOGRAPHY: COURTESY SOM (TOP); © DAVID SUNDBERG/ESTO (BOTTOM); CHUCK CHOI (OPPOSITE, TOP)

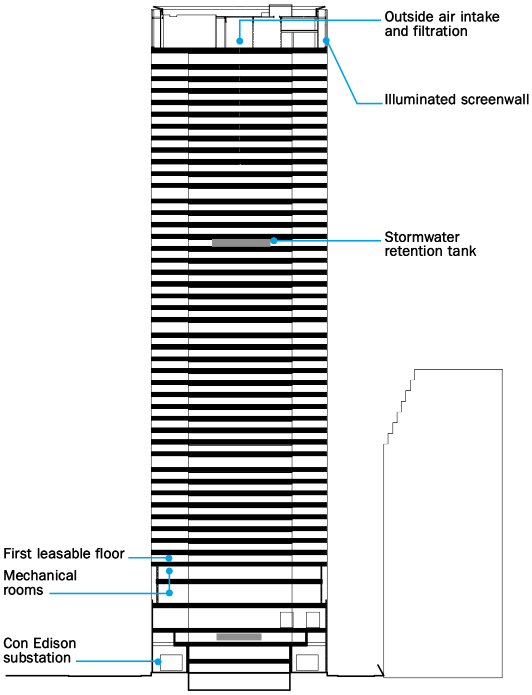
Childs says. It took some convincing for Silverstein, since it meant a reduced building footprint and a final size, even at 1.7 million square feet, that represents less space than that allowed by zoning. Furthermore, the substation, as well as mechanical equipment, occupies the first 10 floors, so leasable space fills only 42 floors. This base, which needed to be well ventilated and accessible, posed a serious challenge for architects of a speculative core-and-shell office building.

Solution

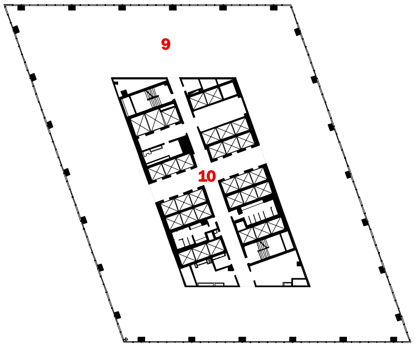
SOM made two key decisions that ensured the tower's success: the aforementioned restricted footprint, with the building on the site's west side, leaving space for a public plaza between Greenwich and West Broadway, and the collaboration with some celebrated names—James Carpenter, the light and glass artist, and Permasteelisa, the facade manufacturer—to develop the multifaceted curtain wall.

7 WTC's curtain wall has four surface articulations—the stainless-steel base at the substation, a ventilated glass curtain wall for mechanical rooms, 42 stories of clear glass curtain wall, and an illuminated crown similar to what SOM designed for its 2003 Time Warner Center. With Carpenter, SOM designed the base as a two-layer wall of stainless-steel, triangular-section wires, equally spaced and rotated along a support armature like a sleek, Minimalist picket fence. In daytime, sunlight bathes this facade, creating moiré patterns that activate the building along the sidewalk. Farther up, the glass curtain wall appears to dangle from the building, as a recessed stainless-steel spandrel reflects light to the backside of the glass overhang (see the top of the wall section on the opposite page). At night, LEDs installed behind small columns reflect on the interior wire layer and transform the building.

Less apparent in the building are the structural and safety innovations that have already affected skyscraper design. Silvian Marcus, the project's structural engineer and the C.E.O. of Cantor Seinuk, designed

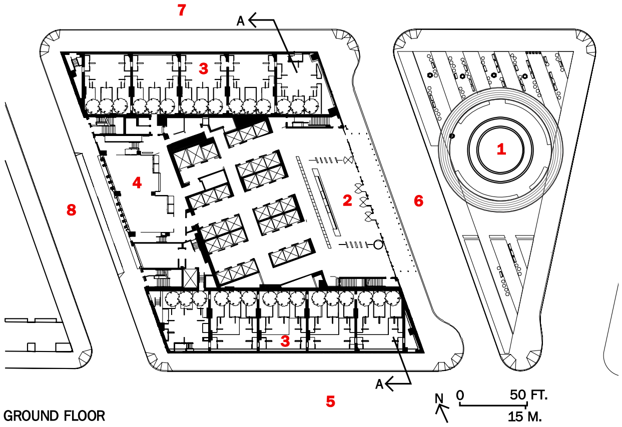


SECTION A-A

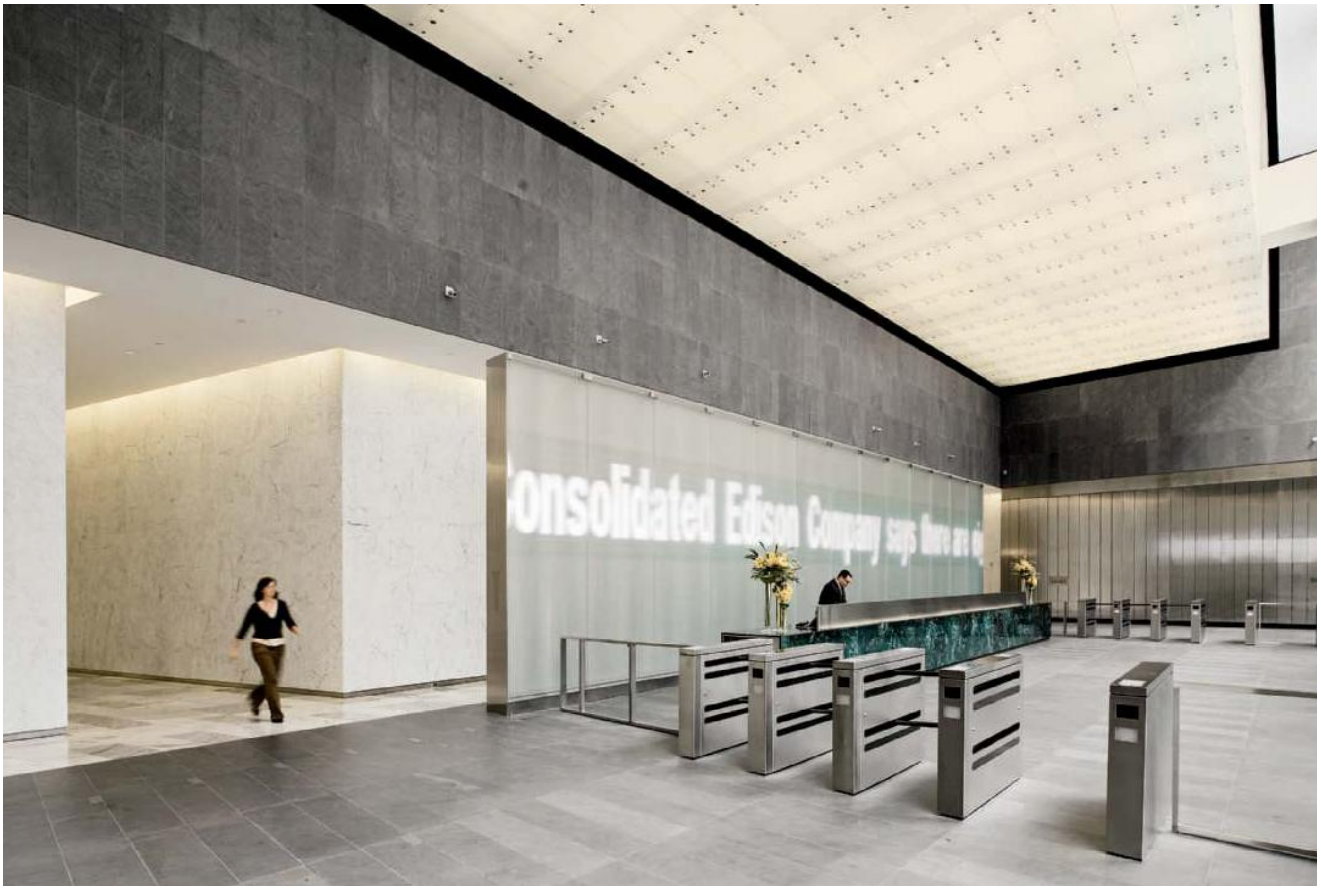


TYPICAL FLOOR

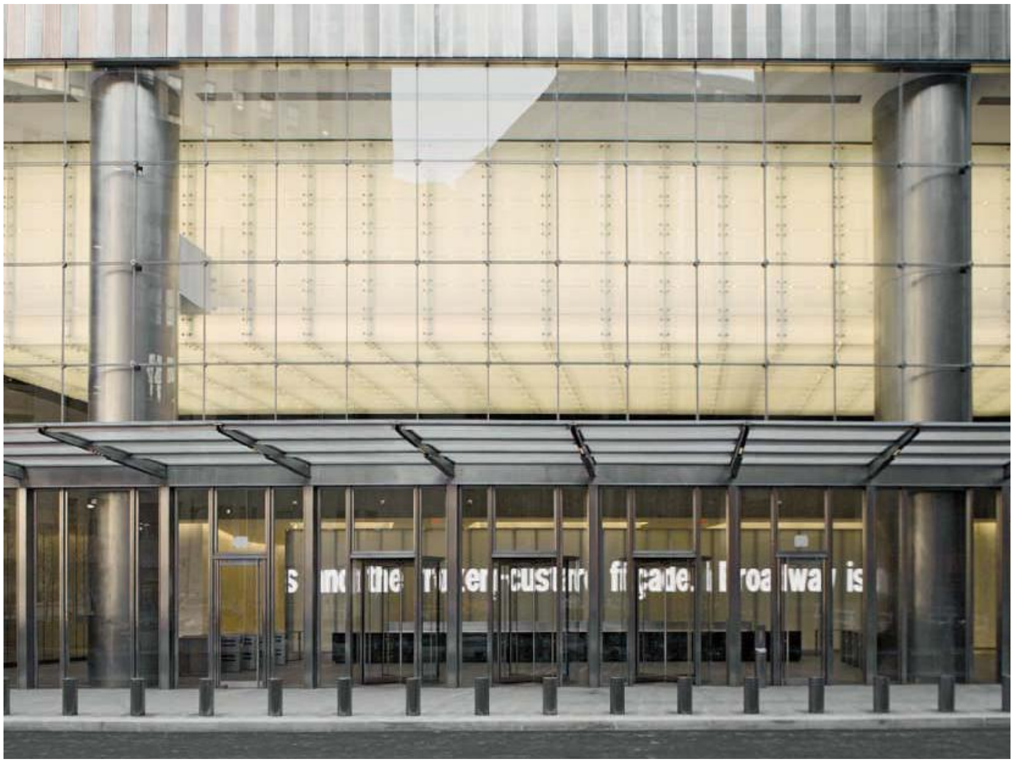
1. *Plaza*
2. *Lobby*
3. *Con Edison substation*
4. *Loading dock*
5. *Vesey Street*
6. *Greenwich Street*
7. *Barclay Street*
8. *Washington Street*
9. *Typical column-free floor plate*
10. *Robust core*



GROUND FLOOR



The Jenny Holzer LED installation (above) cantilevers 14 feet from the floor on a structure designed by Bill Baker, of SOM's Chicago office. The sumptuous lobby, which belies the fact that 7 WTC is a LEED Gold–rated core-and-shell office building (the first in New York), is finished in white and gray marble. A hanging glass wall (right), glass canopy, and an illuminated glass ceiling outfitted with red, white, and blue dimmable T5 fluorescent lamps fosters an atmosphere of smooth luminosity.



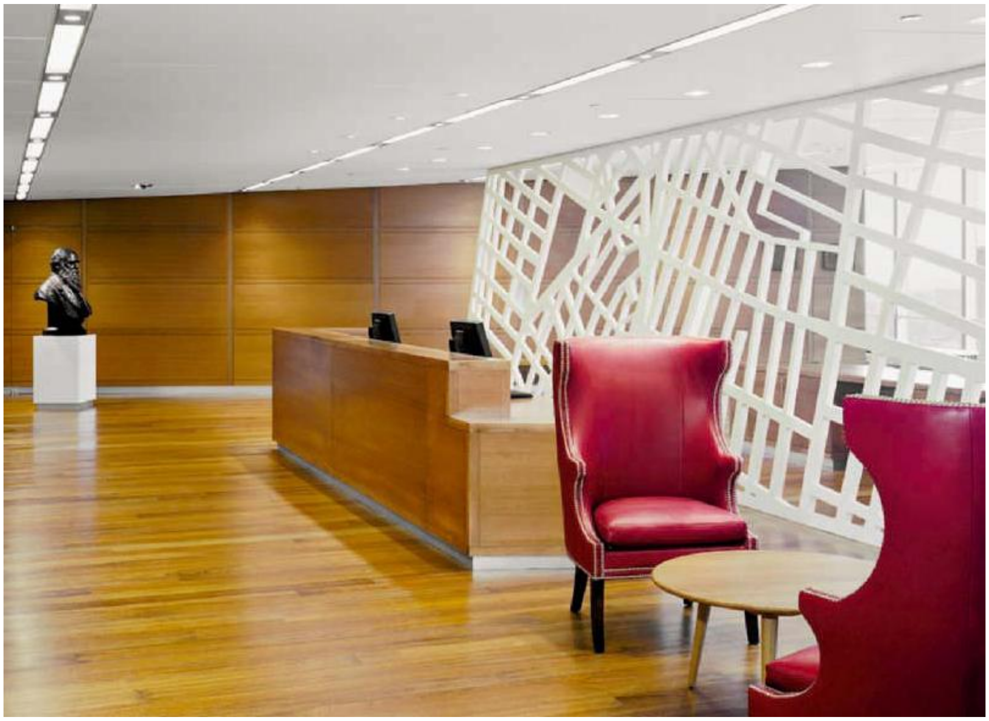
PHOTOGRAPHY: © CHUCK CHOI (TOP); DAVID SUNDBERG/ESTO (BOTTOM); MARK LAROSA (OPPOSITE TWO) the original 7 WTC as a total steel structure, but this time around he developed a robust concrete core and a perimeter of redundant steel columns—to address progressive collapse concerns—that leaves the interior completely open.

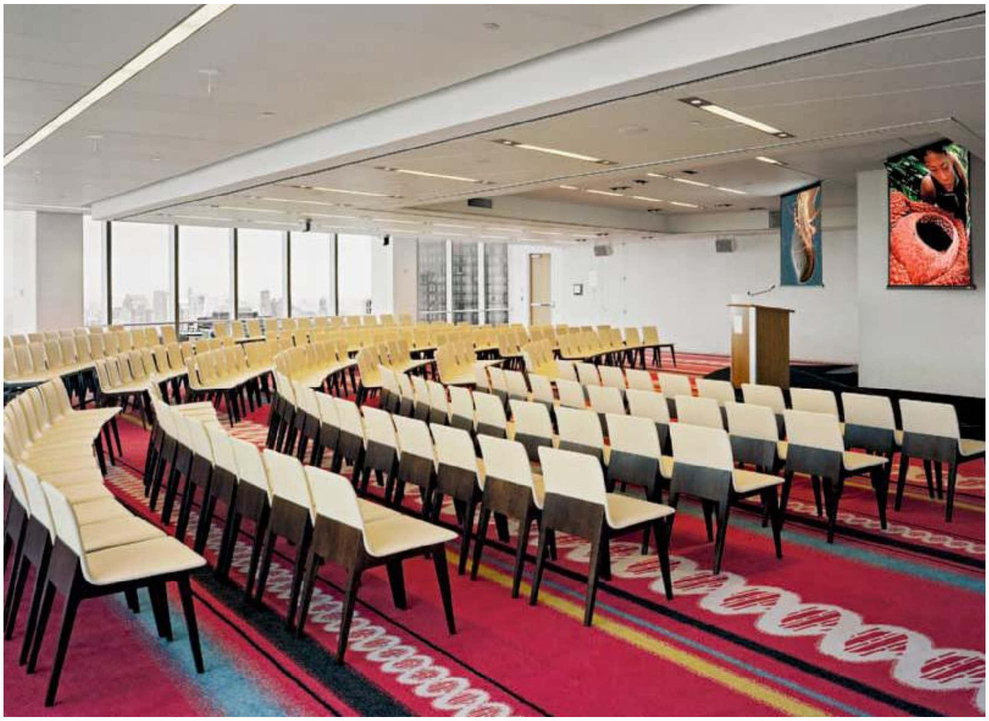
Although coordinating work between two separate unions—for concrete and steel—makes New York projects notoriously difficult, Marcus says the core approach enhances safety. The perimeter columns tie back to the core with what he calls "outriggers," trusslike devices that free the columns to only support gravity loads, thereby reducing their size and making the failure of any given column less important to overall structural integrity. Cantor Seinuk plans to use this approach for its work at Freedom Tower and the other WTC skyscrapers.

In large part due to 7 WTC, the International Code Council recently added the requirement of an additional exit stair for buildings over 420 feet high. The stairs at 7 WTC, brushed with intumescent paint, are already 20 percent wider than code requirements and exit directly to the street, avoiding the lobby.

Commentary

No other Manhattan tower of recent vintage comes close to the mesmerizing surface effects of 7 WTC, from its startling base through its variegated reach to the sky. In terms of sheer luminous exuberance, only Norman Foster's 2006 Hearst Tower compares, but it's so cut off from the street to be merely slight and chooses to reserve its best space—the atrium—for employees. At 7 WTC, the ground-level urban gestures—including a dramatic Jenny Holzer LED installation projecting phrases through the lobby's curtain wall and into the plaza designed by landscape architect Ken Smith—are generous, considering Silverstein could have filled the lot with structure. While this project hasn't relieved Childs and company from continued public criticism of Freedom Tower, it has certainly added a significant artifact to Manhattan's unparalleled collection of skyscrapers. ■





H3 Hardy Collaboration Architecture designed a new home for the New York Academy of Sciences on the 40th floor of 7 WTC. The space, which opened in October 2006, takes its cues from the academy's interests, including oversize photographs of flowers that line an office corridor that slices north–south through the floor. The flowers were produced in cooperation with graphic designers 2x4. The screen wall in the lobby (top) illustrates the New York street grid, indicating the academy's previous locations. The lecture hall (above) affords enviable panoramic views of the city.

Two: SPORTS CITY TOWER

Doha, Qatar, United Arab Emirates

AREP and Hadi Simaan bestow an icon, with drama and engineering finesse, on a rapidly developing city in the United Arab Emirates.

By Sam Lubell

Architect: *AREP, with Hadi Simaan—Etienne Tricaud, partner in charge; Bruno Sarret, project architect; Ali Dehbonei, on-site architect; Eric Dussiot; Marie-Odile Bosc; Alan Murray; Cyril Hugon; Ana Paula Vaz Correa; Stephane Mairesse; Hadi Simaan Architects—Hadi Simaan, principal*
Client: *State of Qatar*
Consultants: *Arup (structural, m/e/p, acoustics, fire, wind and vibration analysis); ECART (interiors); Kevan Shaw Lighting Design (lighting, LED programming); Gilles Drossart (renderings)*
General contractor: *BESIX with MIDMAC*

Size: *430,556 square feet*
Cost: *$175 million*
Completion date: *May 2007*

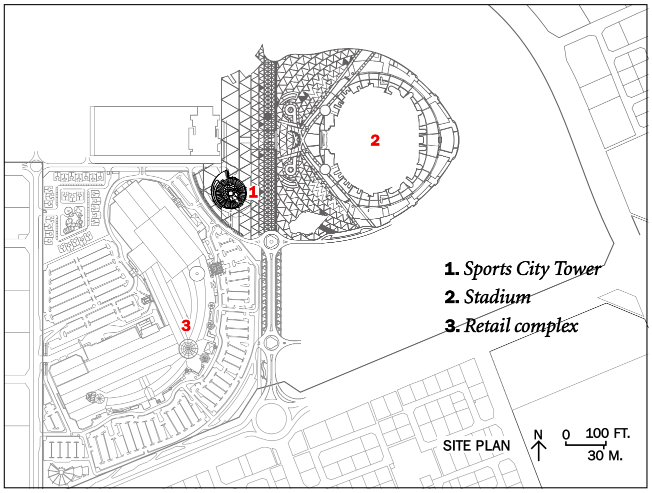
Sources
Structural system: *Arcelor*
Glass and skylights: *Saint Gobain*
LEDs: *Philips Lumileds Luxeon LEDs*
Lighting control system: *Artistic License Colour Tramp, with Art-Net DMX*

ONLINE: Rate this project and access additional sources at **architecturalrecord.com/bts/**.

The Sports City Tower, constructed in Doha, Qatar, for the 15th Asian Games last November and December, is not a practical building. The 430,000-square-foot structure's usable floor area is paltry considering its 1,000-foot height. But French firm AREP was not instructed by its client, Qatar's heir apparent Sheikh Jassim Bin Hamad, to worry about practical issues. They were instructed to produce a building that would become a memorable symbol for the fast-growing country.

Program

The 51-floor, parabolic-shaped tower, which served as a giant torch for the games last year, also includes other building components cantilevered from its concrete core: an 18-story hotel, a three-story sports museum, a four-story presidential apartment for Sheikh Bin Hamad, a three-story rotating restaurant, and a two-story viewing deck at the top. Because of delays at the outset (including a change of contractor and architect), the architects had to realize the $175 million project in 18 months. The tower has not been able to attract an operator for its hotel, thus its interiors have not been finished.



Solution

AREP, selected for the project in 2005, worked with a conceptual sketch by local architect Hadi Simaan, who had envisioned a structure whose tapering shape would enhance the presence of the flame for the Asian Games and contrast sharply with the flat desert.

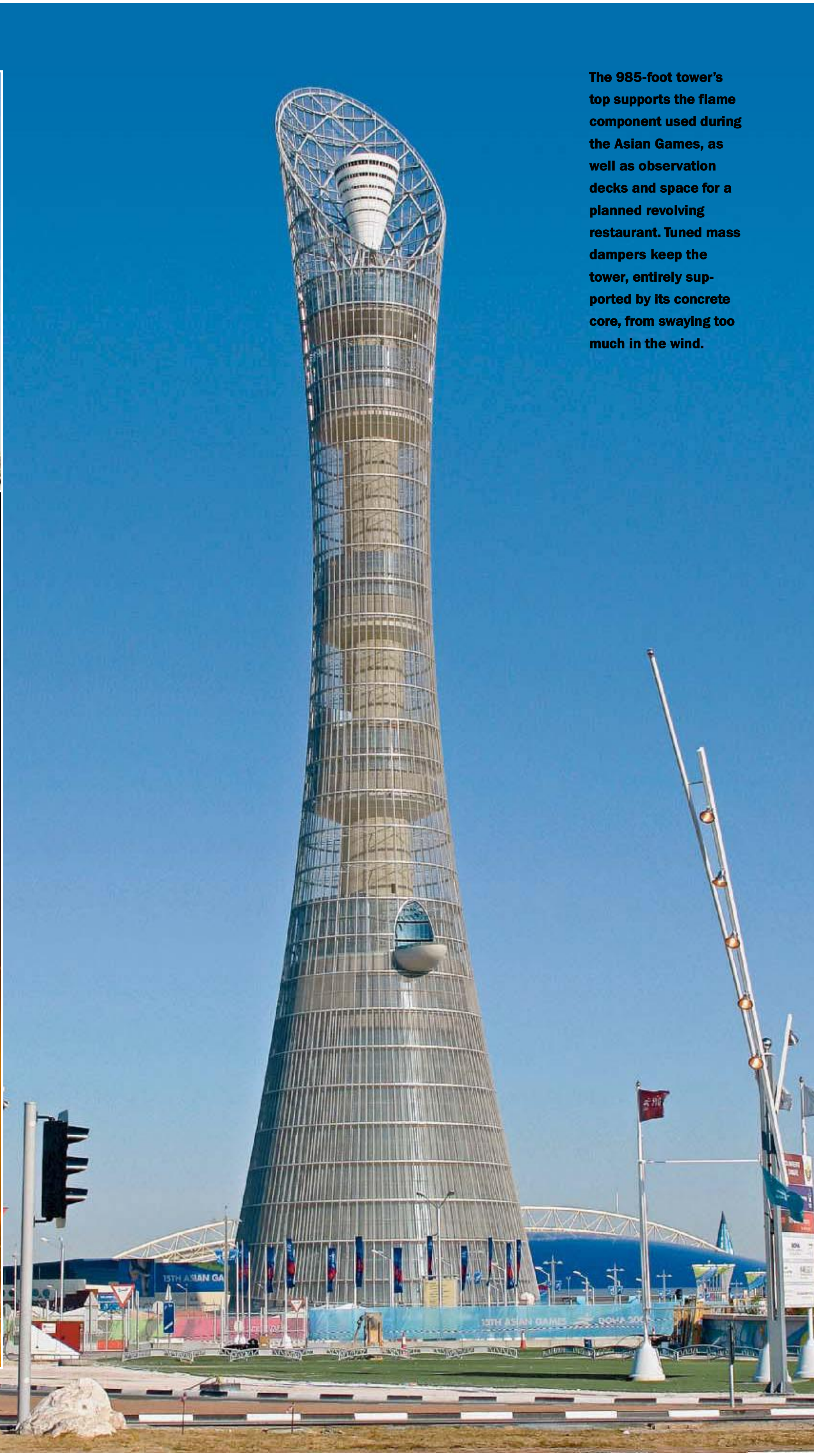
Developed closely with structural engineers in the London office of Arup, the final form consists of a 3-to-6-foot-thick, reinforced-concrete cylinder (the core), varying from 40 to 60 feet in diameter, encircled with radiating networks of cantilevered steel beams on each floor of its building modules. The modules themselves are composed of steel columns, metal decking, concrete slabs, and outer tension and compression ring beams, which support glass-paneled outer walls. The bottom of each module is covered with glass-fiber-reinforced concrete. Beams, as well as steel struts tying all the structural components together, are bolted through the concrete core and hence are anchored into place, transferring vertical loads from perimeter columns and ring beams to the core.

Outside the modules, AREP suspended a taut, transparent steel-mesh cladding—giving the building its shape—mounted on a steel frame attached to the building's outer ring beams. The gridlike mesh's vertical spacing gets wider as it moves up the building, adjusting to increasing wind. It gets narrower on the south-facing side to adjust to increased sunlight. The building is 230 feet wide at the bottom, 85 feet high in the center, and 108 feet wide at the top.

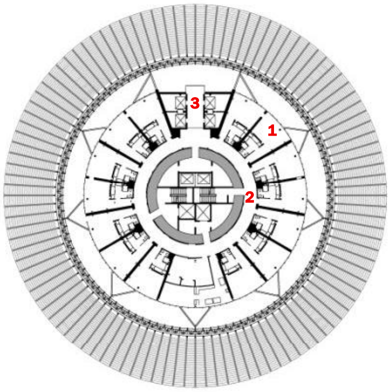
A long tube for the flame is set

Sam Lubell is the California editor of The Architect's Newspaper.

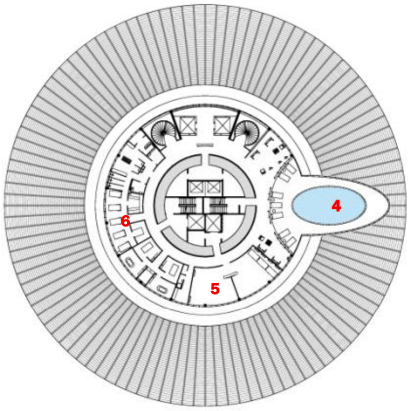
PHOTOGRAPHY: COURTESY AREP AND BESIX/MIDMAC


15TH ASIAN GA
15TH ASIAN GAMES DOHA 200

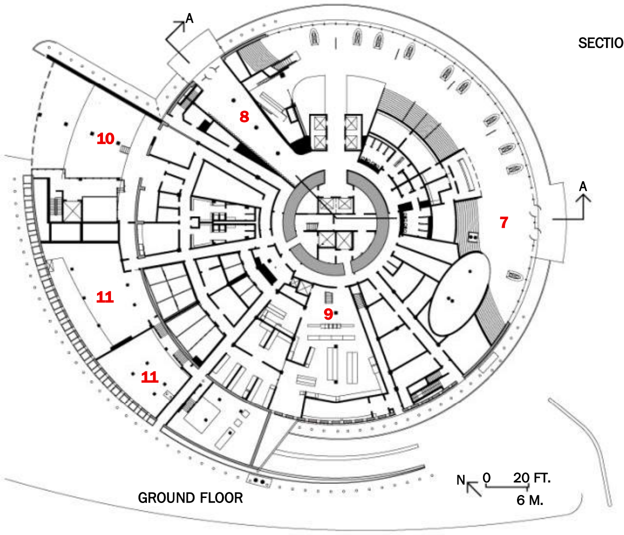
The 985-foot tower's top supports the flame component used during the Asian Games, as well as observation decks and space for a planned revolving restaurant. Tuned mass dampers keep the tower, entirely supported by its concrete core, from swaying too much in the wind.



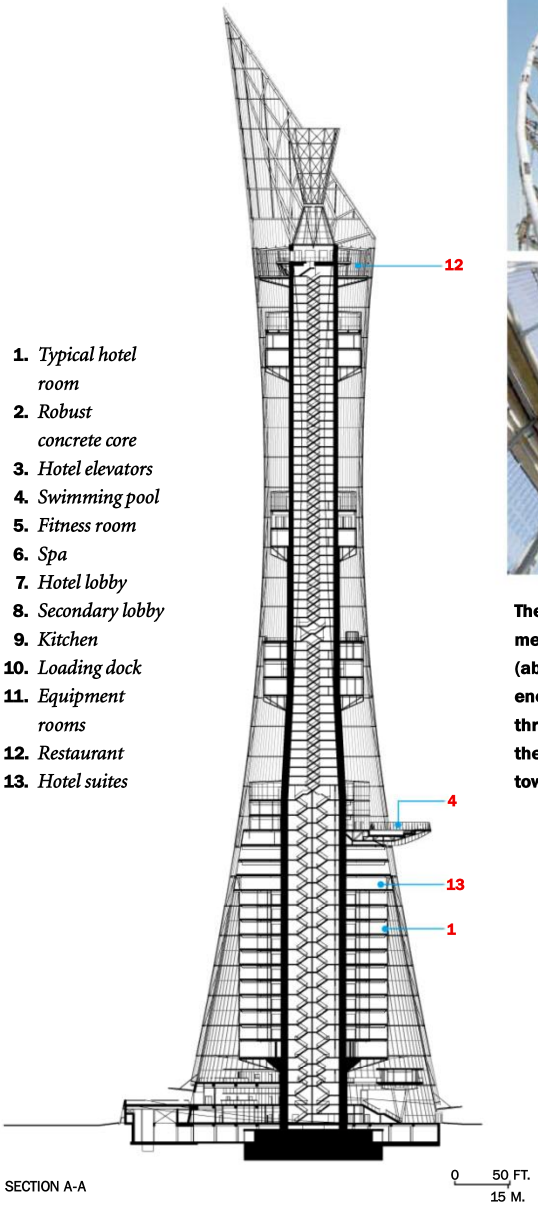
TYPICAL HOTEL FLOOR



18th FLOOR/SPA

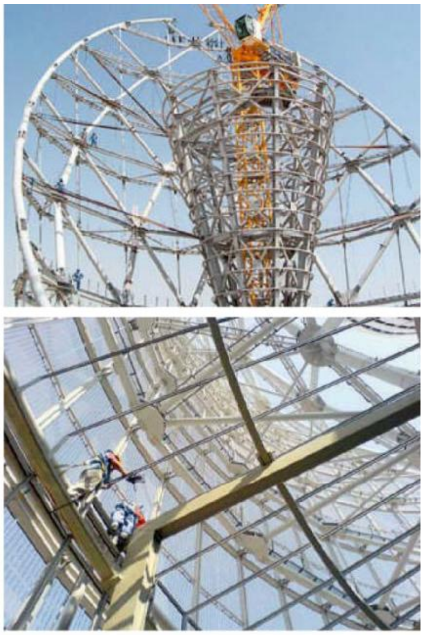

A
8
10
A
7
11
9
11
N
0 20 FT.
6 M.

GROUND FLOOR

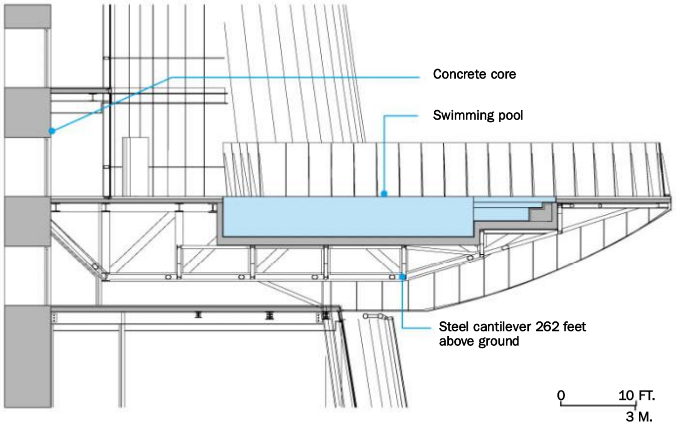

12
4
13
1
0 50 FT.
15 M.

SECTION A-A

1. *Typical hotel room*
2. *Robust concrete core*
3. *Hotel elevators*
4. *Swimming pool*
5. *Fitness room*
6. *Spa*
7. *Hotel lobby*
8. *Secondary lobby*
9. *Kitchen*
10. *Loading dock*
11. *Equipment rooms*
12. *Restaurant*
13. *Hotel suites*



The wider-spaced steel mesh at the pinnacle (above and top) allows enough wind to pass through to mitigate the heat effects of the tower's flame.


Concrete core
Swimming pool
Steel cantilever 262 feet above ground
0 10 FT.
3 M.

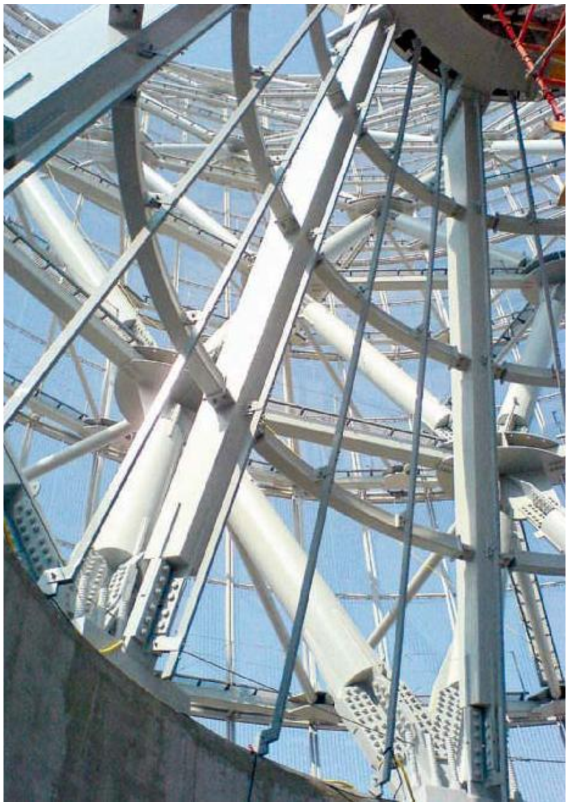
inside a 100-foot-tall, upside-down, aluminum-panel-clad cone, which is itself set inside a 230-foot-high steel diagrid frame. The frame is anchored at its bottom via a concrete frame reinforced with a circumferential ring beam that is attached to the core via a radial arrangement of concrete columns. AREP project director Bruno Sarret points out that high winds prevent the flame's heat from causing a fire.

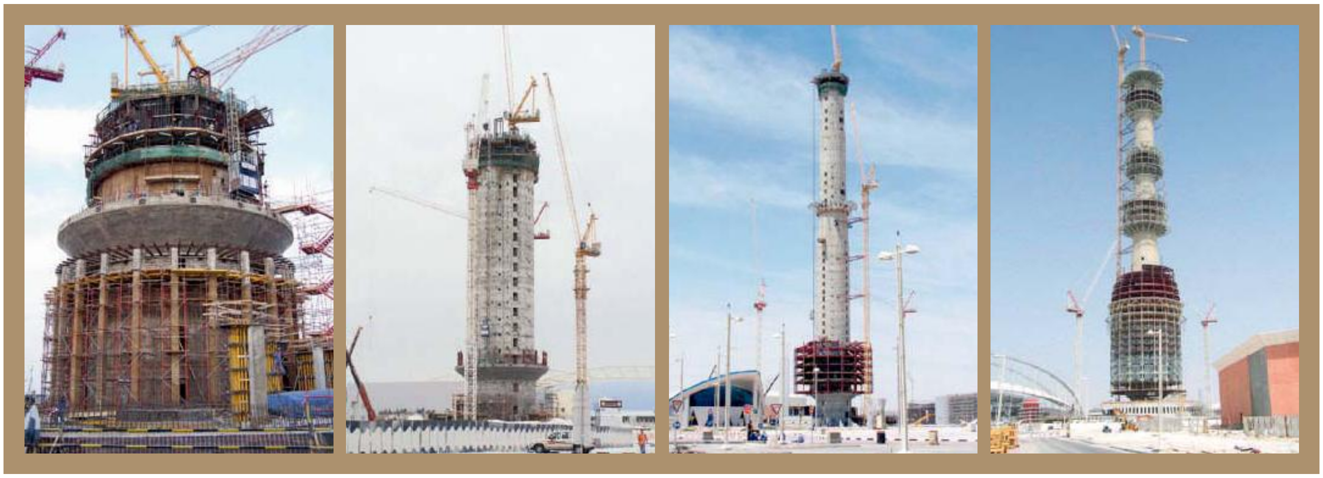
The planned lobby for the hotel is a 230-foot-high space, with a 3-story grand stair and marble floor that will have subtle lanes etched into its surface, reminiscent of a running track.

Commentary

The gargantuan building required some leaps of faith. For instance, the contractors, BESIX, were uneasy about the flame's effect on the rest of the building until the day it was first lit. "They warned us, 'You don't want to end this thing on a bad note,' " says Sarret.

Although it is disappointing that the hotel has not been realized, the tower is easily the tallest, most dramatic element in a series of public projects—composing the 320-acre Sports City just east of downtown—that includes a new stadium, arenas, and a mosque. At night, a display of 4,000 LED lights, wired inside the frame, explodes in a series of colors and designs that produce exactly the effect they should: shock and amazement. ■





The glass-enclosed lobby (below left and right) echoes the structural bravado of the steel, mesh, and concrete at the tower's top (left). The lobby's interiors, designed by the French firm ECART, should be finished by 2009. The complex construction sequence of the tower (bottom) required contractors to pour the concrete core first and then follow behind with the cantilevered steel structural components that will eventually support hotel functions.

Three: MONTEVIDEO TOWER
Rotterdam, the Netherlands

Mecanoo transforms a postindustrial pier with a multifaceted residential tower in one of Europe's most architecturally progressive cities.

By Penelope Dean

Architect: *Mecanoo Architecten—Francine Houben, director; Aart Fransen, technical director; Allart Joffers, senior architect*
Client: *ING Real Estate*
Consultants: *ABT (structural); Schreuder Groep (m/e/p); Adviesbureau Peutz & Associates (environmental); Ineke Hauer, Rick Vermeulen (artists); Kats & Waalwijk Group (project management)*
General contractor: *BESIX*

Size: *619,250 square feet*
Cost: *$120 million (estimated)*
Completion date: *May 2006*

Sources
Elevators: *Kone*
Concrete formwork: *Doka*

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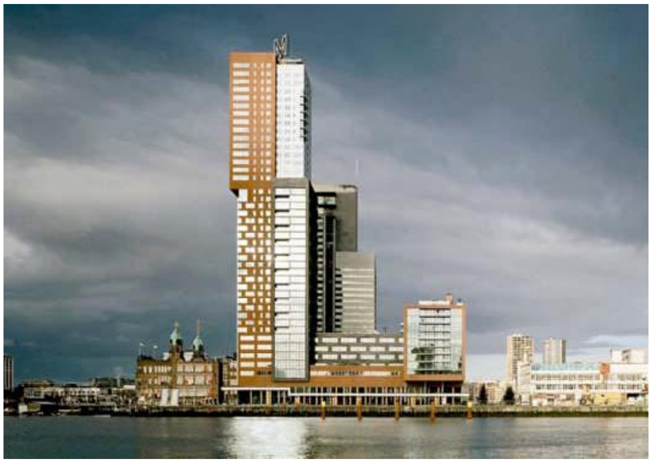
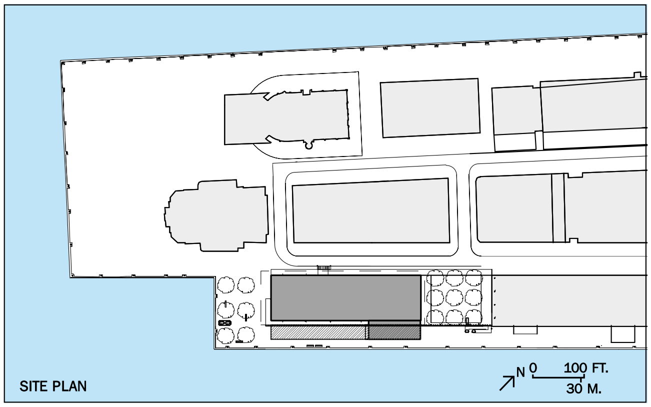
Sitting somewhere between the Erasmus Bridge designed by Ben van Berkel, the Euromast or "space tower" designed by H.A. Maaskant, and almost perfectly aligned above the twin black towers designed by Wiel Arets, a giant, rotating letter *M* floats on top of what is fast becoming Rotterdam's crowded riverfront skyline.

It is not until one is moving south down Rotterdam's central street—the *Coolsingel*—to cross the Erasmus Bridge that the rotating *M*'s "pedestal" finally comes into view: a tall, thin, gray-white-and-orange tower, clad with different materials, at the end of Rotterdam's Wilhelmina Pier. Turning right and moving toward the end of the pier, this recently completed tower, designed by the Dutch architects Mecanoo, now appears as a series of superimposed volumes. And it is not until one actually enters the tower's lobby that the giant letter *M* begins to make any sense: a map of Uruguay revealing the *M* not only as the initial for its capital city, but also the tower's name—Montevideo—and, according to the architects, a "logo" to confirm "Rotterdam's maritime tradition."



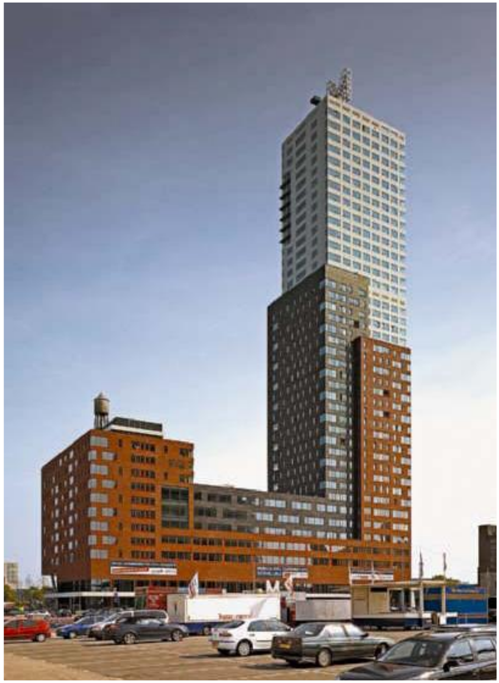


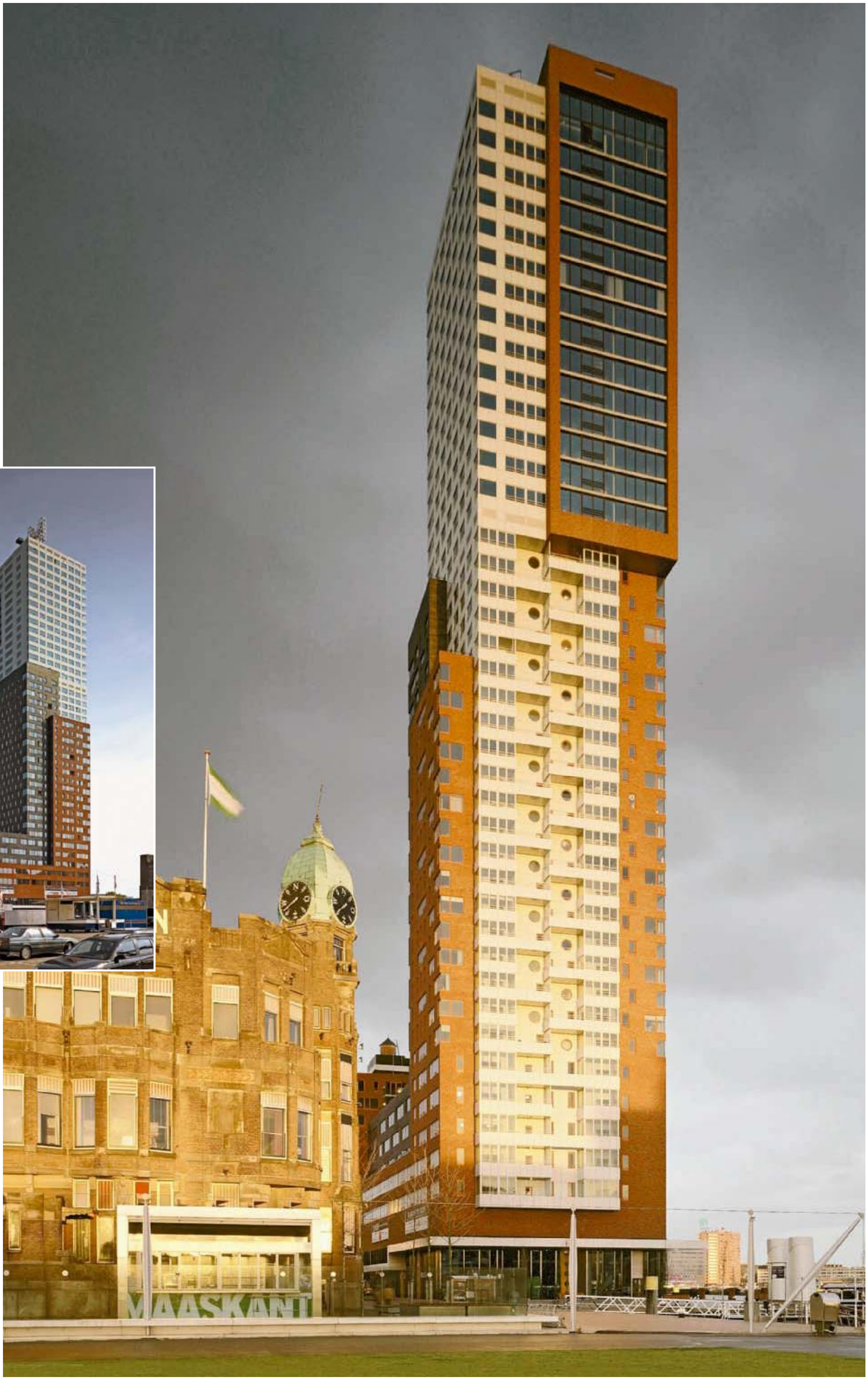
PHOTOGRAPHY: © CHRISTIAN RICHTERS

Program

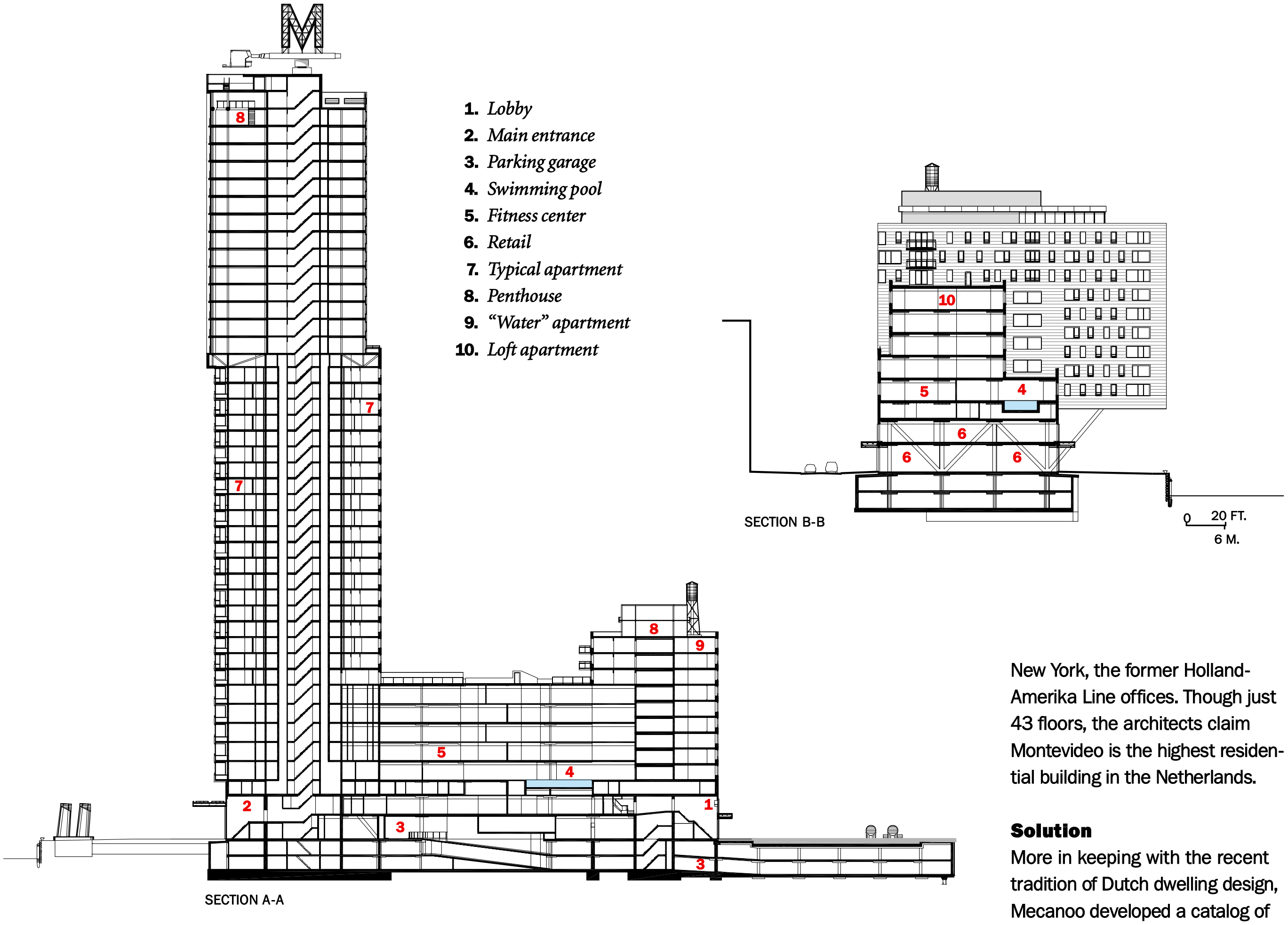
Commissioned by ING Real Estate and the Rotterdam Urban Planning Agency in 1999, Mecanoo's Montevideo is one of several tall buildings planned for the Wilhelmina Pier area, part of Rotterdam's old city harbor now free for development after port activities moved west, closer to the coast. Aptly labeled "Skyscraper City," the area forms part of a master plan, designed by Foster + Partners in London, aimed at integrating commercial and residential zones with recreational and urban programs. As predominantly residential, Montevideo sits at the southern side of the pier adjacent to Hotel

Penelope Dean is an architect and assistant professor of architecture at the University of Illinois at Chicago.





The east-west section of the nearly 500-foot Montevideo tower looks like an oversize serif-font *L*, another “initial letter” branding the building up close, just as the *M* allegedly brands from afar. The tower’s prominent Wilhelmina Pier location (opposite) assures the *M*, designed by Rick Vermeulen, can be seen throughout the port city.



1. *Lobby*
2. *Main entrance*
3. *Parking garage*
4. *Swimming pool*
5. *Fitness center*
6. *Retail*
7. *Typical apartment*
8. *Penthouse*
9. *"Water" apartment*
10. *Loft apartment*

The cantilever supports the "Water" apartments (above left). In the lobby (above), a map of Uruguay recalls the city's maritime tradition, and the tower's name.

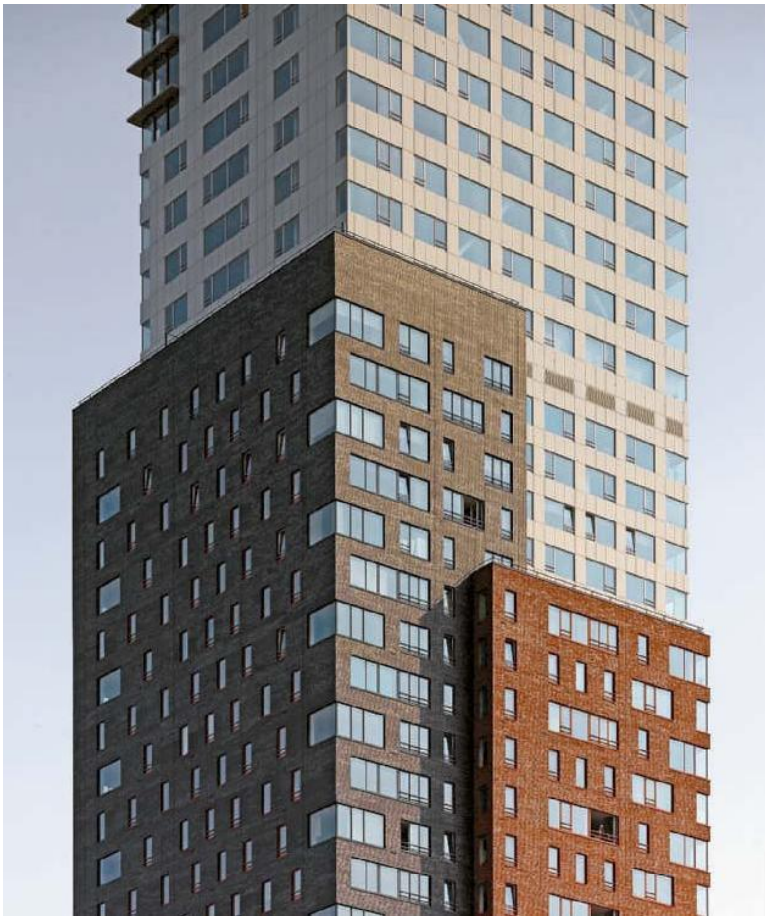
New York, the former Holland-Amerika Line offices. Though just 43 floors, the architects claim Montevideo is the highest residential building in the Netherlands.

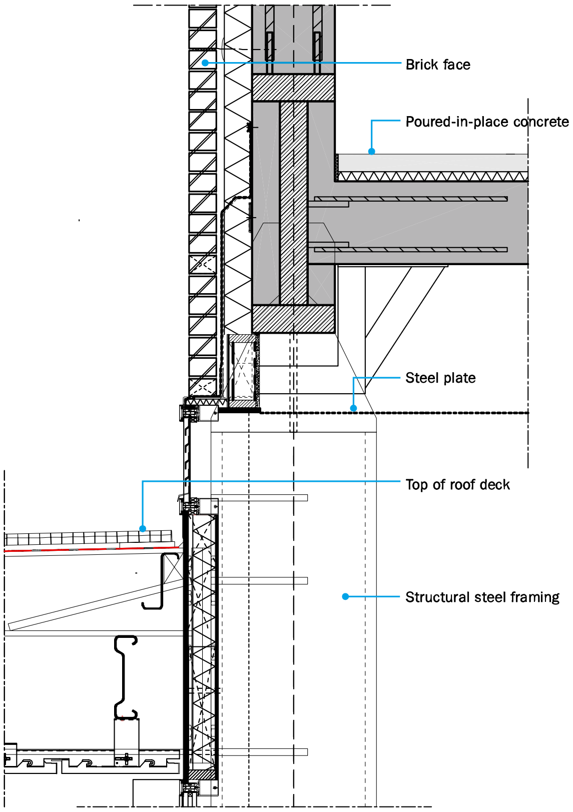
Solution

More in keeping with the recent tradition of Dutch dwelling design, Mecanoo developed a catalog of apartment formats, with different sizes marketed to accommodate a multitude of lifestyles and family types. The firm has developed 54 different types across 129 units.

Programmatically organized in section, the architects piled large flats with varying floor heights into the main tower: five levels of "Loft," 20 levels of "City," and 14 levels of "Sky" apartments, as well as a penthouse. Ten levels of "Water" apartments create a mansion-esque mix in the shorter tower that cantilevers out toward the water. The two towers connect through a five-story horizontal bar containing offices and public facilities, such as a swimming pool and fitness center.

Described by Mecanoo as a "vertical city" composed of "intersecting volumes," at first glance Montevideo's formal composition appears as the result of its programmatic organization. Yet given that

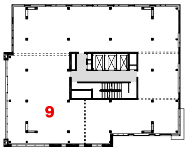



Brick face
Poured-in-place concrete
Steel plate
Top of roof deck
Structural steel framing

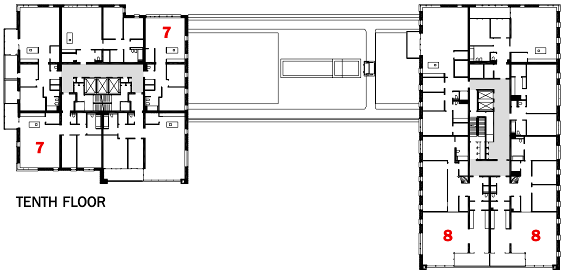
STRUCTURAL TRANSITION DETAIL

A combination steel-and-concrete structure helps to define the variety of facade materials (left) and breaks up the tower's overall volume. This is in contrast to the American preference for repeatable floor plates and uniform materials.

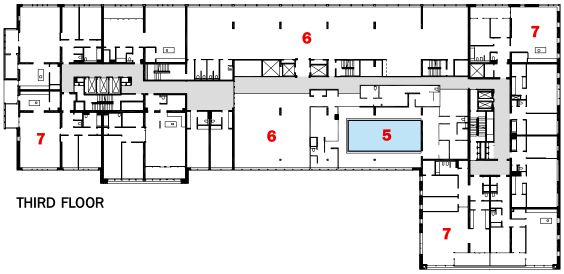
1. *Main entrance*
2. *Lobby*
3. *Retail*
4. *Parking garage ramp*
5. *Swimming pool*
6. *Fitness center*
7. *"Water" apartment*
8. *Two-story apartment*
9. *Penthouse*



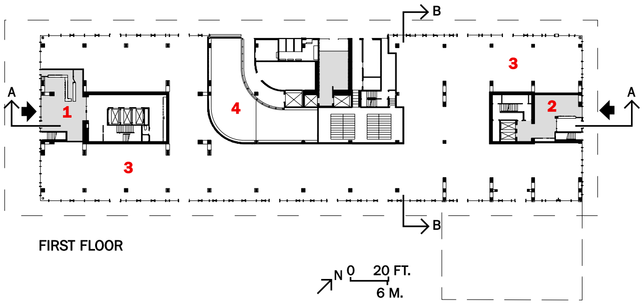
PENTHOUSE FLOOR



TENTH FLOOR



THIRD FLOOR


B
A
1
3
4
3
2
A
B
N
0
20 FT.
6 M.

FIRST FLOOR

Mecanoo designed 54 different types of apartments, including large loftlike units (left), as well as more conventional apartments with balconies facing the River Maas (bottom). A swimming pool on the third level (below left) is part of a larger fitness center open to the public. Befitting a luxury building, the 41st-floor penthouse includes its own private swimming pool.

the tower's outline does not directly relate to the extrusion of apartments in plan, the building's profile alludes to a volumetric logic motivated by structural systems and facade articulation. Indeed, it is the alternating construction of steel (the first two floors), followed by a "concrete climbing form" (27 floors), and back to steel again (14 floors), that enables the building to achieve its diverse spatial structure. The different cladding materials—prefabricated concrete, brickwork, and aluminum curtain walls—define each of the tower volumes separately. Only the facades' varying window patterns suggest the array of apartments within. The move away from what Mecanoo refers to as the repetitive "housing project"—a Dutch typology of identical flats accessed from external galleries—toward a more differentiated volumetric composition marks another formal shift: horizontality and legibility now give way to verticality and ambiguity.

Commentary

Perhaps what is most interesting about Mecanoo's Montevideo is the new kind of tower it adds to existing conversations about city skylines. As a slender aggregation of laminated volumes—a sushi roll without the seaweed wrap—it is a divergence away from the American norm of a fat-to-thin section of repetitive floor plates. Instead of breaking down volumetric form, as Skidmore, Owings & Merrill did in the 1973 Sears Tower in Chicago, with its thinning appearance via tapering floor plates as a function of real estate logic, or the stepped-back volumes of Hugh Ferris's 1930s envelope studies derived from Manhattan zoning laws, Mecanoo has simply constructed a collage of boxes. The approach may be best described as a new "visual" typology for the city—thinness—disciplined by vague compositional logics rather than those of context, setback codes, or economics. In what appears to be a more liberated design exercise, Mecanoo's Montevideo points toward the differences in design *investment* between the European and American high-rise. ■

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Miracle on (and Under) Second Avenue

A NEW YORK CITY OFF-AGAIN, AND NOW ON-AGAIN, PUBLIC INFRASTRUCTURE PROJECT DEPENDS UPON INTENSE COLLABORATION BETWEEN ARCHITECTS AND ENGINEERS

By Sara Hart

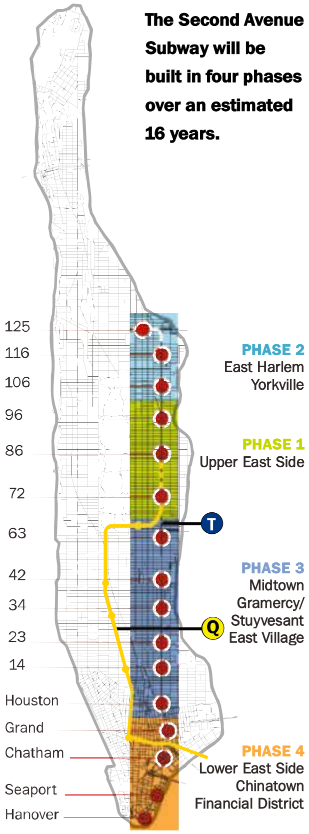
With derisive taglines like “the most famous thing that’s never been built” and “the line time forgot,” news this spring that New York City’s Second Avenue Subway (SAS) was about to start construction was met with nearly unanimous approval tempered by cautious optimism, despite the guarantee of years of unceasing construction affecting hundreds of thousands of Manhattan residents, institutions, and businesses. Public consensus acknowledged that the long-term advantages outweigh the short-term disruptions and inconveniences.

Predicted to cost $16.8 billion (in 2004 dollars), the mega-infrastructure project is the largest public-works undertaking in New York in 50 years. To be built in four phases, over an estimated 16 years, the new subway—also known as the T Line—will serve approximately 500,000 riders daily at 16 new stations along 8.5 miles of new track. It will relieve the overburdened Lexington Avenue Line, the only subway serving the East Side, which reportedly operates at 120 percent capacity.

Almost from the moment of conception in 1929, the project became the perennial victim of every 20th-century economic crisis and vagary of war. During the Great Depression, the project was scaled back and then postponed indefinitely in 1939. A new master plan was considered, then suspended in 1941 along with other nonessential public works, when the U.S. entered World War II. Another postwar scheme was shelved due to huge inflation experienced during the Korean War. Multiple iterations later, construction began in 1972, only to be abruptly halted as New York City teetered on the brink of bankruptcy.

Another 20 years went by, and finally the Metropolitan Transit Authority (MTA) and New York City Transit (NYCT) began the Manhattan East Side Alternatives Study. The goal was to recommend a course of action to reduce crowding and delays on the Lexington Avenue Line and create mass-transit accessibility for the far East Side of Manhattan. The study team compiled a list of more than 20 alternatives to resolve existing and future transportation issues, including the resurrection of the master plan for a new Second Avenue Subway.

In July 2004, the Federal Transit Administration (FTA) certified that the requirements of the National Environmental Policy Act had been satisfied for the Second Avenue Subway project. By December, preliminary engineering was completed for all four phases. Two years later, in April 2006, Extended and Final Preliminary Engineering was done. The FTA then authorized the MTA to begin the Final Design of Phase I. On April 12, 2007, the governor, other state and city officials, and several transit administrators broke ground for the fourth time since 1929 and declared the project under way. And they mean it this time.


The Second Avenue Subway will be built in four phases over an estimated 16 years.

It takes a big village to build a subway

Public infrastructure projects are by definition enormously complex undertakings, involving dozens of local, state, and federal agencies; community boards; arts commissions; and teams of architecture, engineering and construction consultants. Officially, the MTA and the NYCT are the clients. In that role, the MTA assembled a team to plan, design and engineer, schedule, and oversee construction of the phased project. This team, a DMJM Harris/Arup joint venture, is a complex, expansive architecture and engineering partnership. The principal players of the joint venture, representing all the design and engineering specialties, work under one roof under the authority of the NYCT’s Second Avenue Subway Project, an entity of the MTA Capital Construction Company.

“There are many stakeholders involved in every phase of planning and design,” says Anil Parikh, SAS program manager. “We conduct working groups with technical advisers, the design team, and user representatives to discuss constructibility, operations, and maintenance, and then investigate options, debating the pros and cons of each,” he explains.

Sara Hart, a former RECORD *editor, is a New York City–based freelance writer.*

CONTINUING EDUCATION

Use the following learning objectives to focus your study while reading this month’s ARCHITECTURAL RECORD/ *AIA Continuing Education article. To earn one AIA learning unit, including one hour of health safety welfare credit, turn to page 166 and follow the instructions.*

Learning Objectives
After reading this article, you should be able to:
1. *Discuss the history of the Second Avenue Subway project.*
2. *Explain the excavation methods that will be used to create the subway’s tunnels.*
3. *Discuss the project’s noise- and vibration-mitigation features.*

For this story and more continuing education, as well as links to sources, white papers, and products, go to **architecturalrecord.com/tech/**.

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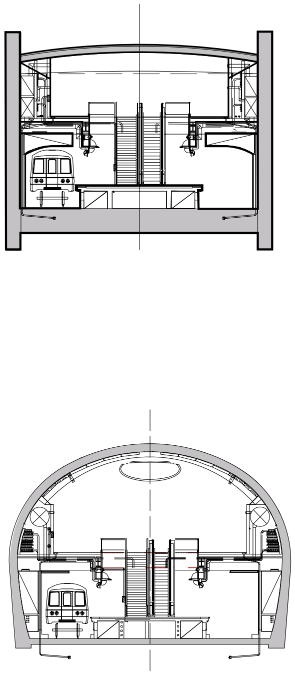
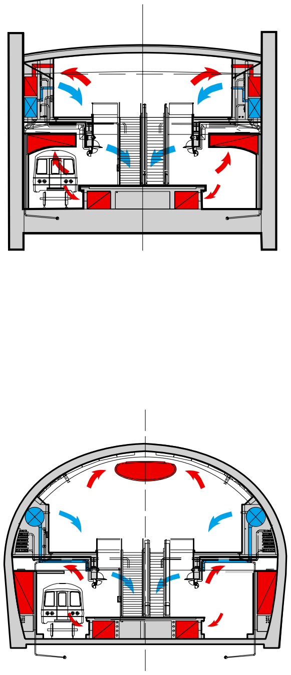
STATION TECHNOLOGIES

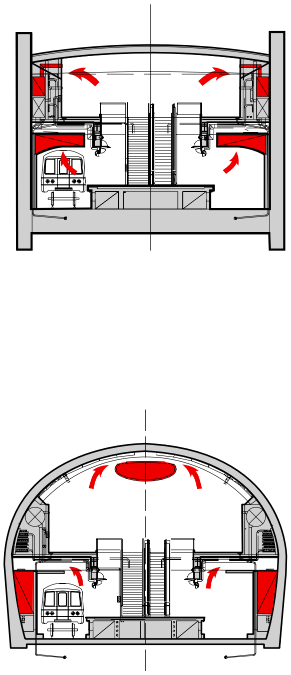
1 Structure



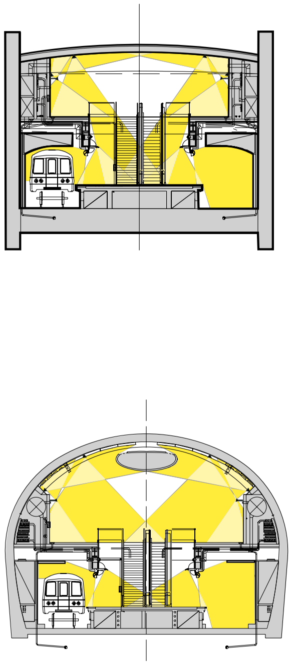
2 Ventilation / Air Tempering



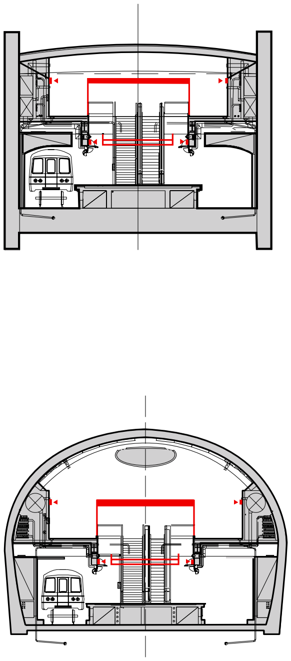
3 Smoke Management



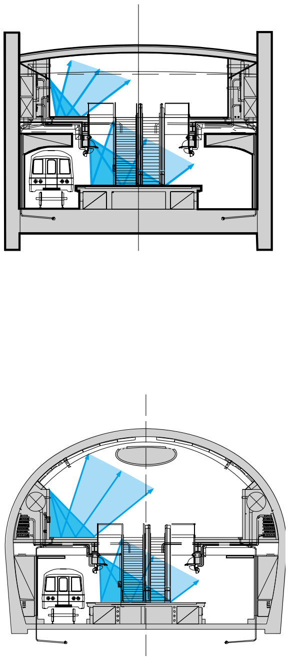
4 Lighting



5 Signage



6 Acoustics



1. The Second Avenue Subway Stations, whether vaulted or rectangular in profile, are column-free to the extent possible. This structural strategy will improve passenger flow, visibility, and security. In order to achieve the column-free structure without excessive cost or large beam depths, economical structural spans and spacing modules are incorporated into station design.

2. The underplatform and overtrack exhaust systems are central to the air-tempering and ventilation strategies. Exhaust ducts and fans will remove air from areas closest to the two largest sources of heat in the station—the brakes and car air conditioners. In the winter, by turning these exhaust systems off, enough heat will be retained within the station to render mechanical heating unnecessary.

3. During a fire, the mechanical system operates in an emergency mode and extracts smoke from the tunnel and underground stations. Simultaneously, the system provides fresh air to passenger egress areas, to create zones of higher air pressure and to minimize migration of smoke.

4. The lighting design for the Second Avenue Subway will improve the passenger experience with brightly lit walls, enhanced lighting at transition points, and the use of daylight, especially at entrances. Energy-efficient technologies, in concert with a station-wide lighting control system, will be incorporated throughout.

5. The new subway line's signage will employ both fixed and variable messaging elements. The centrally controlled variable-messaging system will display updated train information and emergency information. Fixed and variable signage will be integrated into the architectural features to increase visual clarity and enhance navigation.

6. Through geometry and the strategic use of sound-absorptive materials, the stations will provide comfortable aural environments with a clear and intelligible public address system.

Exit
HOLD ESCALATOR HANDRAILS

Transparent canopies will define station entrances, provide protection from the elements, and bring daylight into station mezzanine levels.

Although many alternatives are identified for every stage, all decisions must answer to a higher power—the assessments of the painstakingly researched environmental-impact statement. Because the SAS project is the beneficiary of federal funding, such an evaluation was required prior to construction in accordance with the National Environmental Policy Act. The client and the FTA recently completed the final environmental impact statement (FEIS). The document notes that although it is final with regard to starting construction, it can be amended as previously unaddressed issues or unanticipated complications arise.

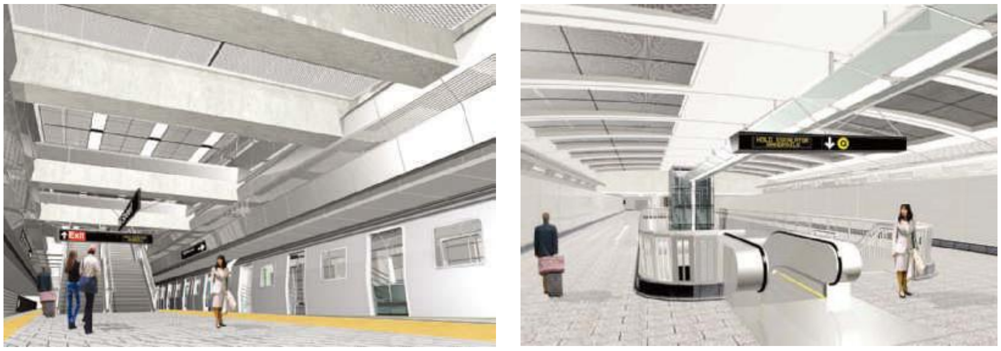
Some of the many factors the FEIS takes into account are the project's potential effects on transit service and roadway congestion, and social and economic conditions. It also considers issues such as air quality, noise and vibration, energy and natural resource use, and contaminated material disposal. Mitigation measures to reduce localized impacts are described in the document. These are requirements, not guidelines. Assessments are based on "reasonable worst-case scenarios," which means that while there may be alternatives for any given process, the FEIS evaluated the one with the greatest potential for disruption. The assumption is that approved alternatives, by definition, fall within the limits set by the FEIS for the worst-case scenario.

THE PRINCIPAL PLAYERS, REPRESENTING ALL THE DESIGN AND ENGINEERING DISCIPLINES, WORK UNDER ONE ROOF.

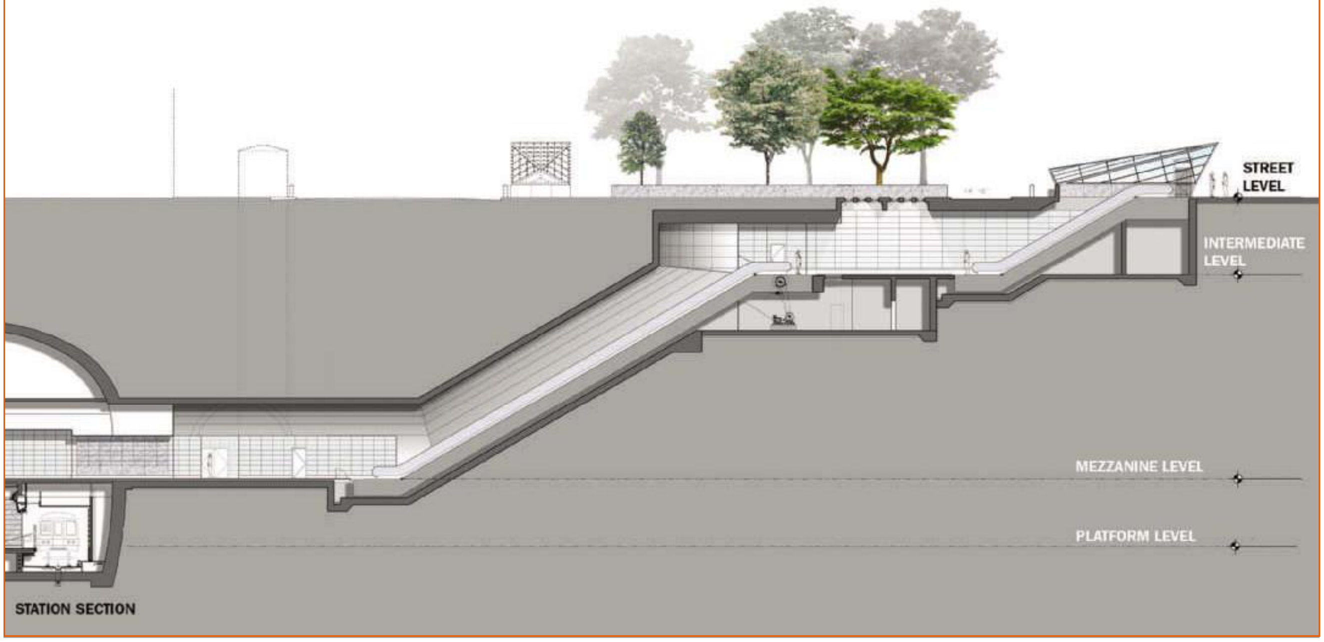
Between rock and a hard place

On-site blasting and excavating are the inaugural steps of most construction projects, and ground breaking usually proceeds without drawing much attention. In the case of the SAS, the sheer breadth and depth of the tunneling effort required considerable evaluation and detailed explanation in the FEIS. The document describes three approved tunnel methods—tunnel boring technology, cut-and-cover, and mining.

Some of the tunnels will be excavated using powerful circular boring machines that drill horizontally through the earth. The project will employ two types of boring technologies—a tunnel boring machine (TBM), for cutting through bedrock, and an earth-pressure-balance machine, to bore through soil. Although the street must be excavated in order to insert either type of machine at the desired depth, the process causes little additional surface disruption.



The profile of the Second Avenue Subway stations and tunnels will be either vaulted or rectangular in shape, defined by the excavation method employed. Platforms (right) and mezzanine levels (far right) will be largely column-free to aid passenger navigation, visibility, and security.



STATION SECTION

Most of New York City's existing subway system was built using the cut-and-cover method. Although it causes the most surface disruption of the three technologies, it is the easiest method for building a section of tunnel that is relatively close to the surface. This method involves digging trenches from the surface, holding back the surrounding earth with retaining walls, and constructing a frame to support a concrete or metal street deck. Cut-and-cover will be used to excavate more than half of the tunnels and to create entrances at every station location.

The third technique is mining, which will be used on portions of tunnel too short to make tunnel boring cost-effective, or for curved sections of the line where the radius is too tight for a TBM. To create tunnels using this method, contractors drill many small holes within a rock area and then place small amounts of explosives in each hole. Under carefully controlled and monitored conditions, explosives are detonated sequentially for short intervals of time, breaking the rock while dissipating the release of energy, lessening the potential for ground vibration at nearby structures.

When mining is done in soil, this so-called "drill-and-blast" process will not be necessary. Soil and rock can be excavated and removed using backhoes, bulldozers, or a clamshell shovel suspended from a crane.

Regardless of which mining method is used, shafts will be required to remove the excavated rock, soil, and debris. Cranes, small rail cars, and conveyors will be used to bring this spoil to the surface. Most of the excavated material will be clean crushed rock, which can be used to fill abandoned mines, build artificial reefs, reinforce bulkheads, and pave roads.

Architecture goes underground

While the tunnels are the conduits for transit services, they are also permanent volumes that define and confine the limits of the architectural and engineering efforts. Tunnel construction techniques yield two basic profiles for the station volumes—vaulted spaces created by the circular motions of the TBMs, and rectangular ones defined by the cut-and-cover method's soil-supporting slurry walls.

DMJM Harris, the architectural arm of the joint venture, has devised modular, transparent canopies at street level to define entrances, provide shelter, and create an openness to contradict the reality of descending into a cavern. Skylights will penetrate sidewalks, wherever feasible, to invite sunlight as far into mezzanines and platforms as possible. The subterranean experience will be enhanced by other factors, including way-finding strategies, temperature control, lighting, and acoustics.

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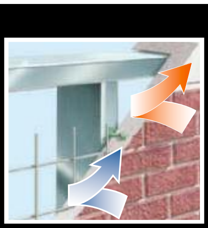

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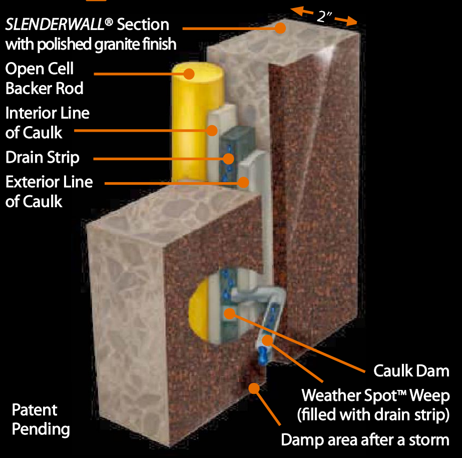

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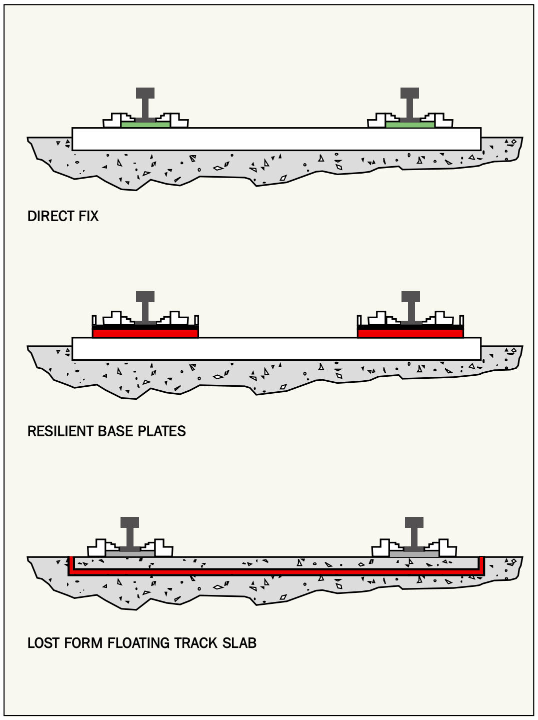


Ventilation equipment will be housed in street-level, multistoried enclosures (above and left) that will incorporate strategies to reduce noise emission, such as the fan-noise attenuator (right). To reduce ground-borne noise from the trains, the design team is investigating several options, including a variation on the "lost form" floating track slab. In this configuration, the rail is fixed directly to a concrete tie block that sits in a resilient surround. Existing subway tracks employ either a "direct fix" or "resistant base plate," which provide little or no vibration mitigation.

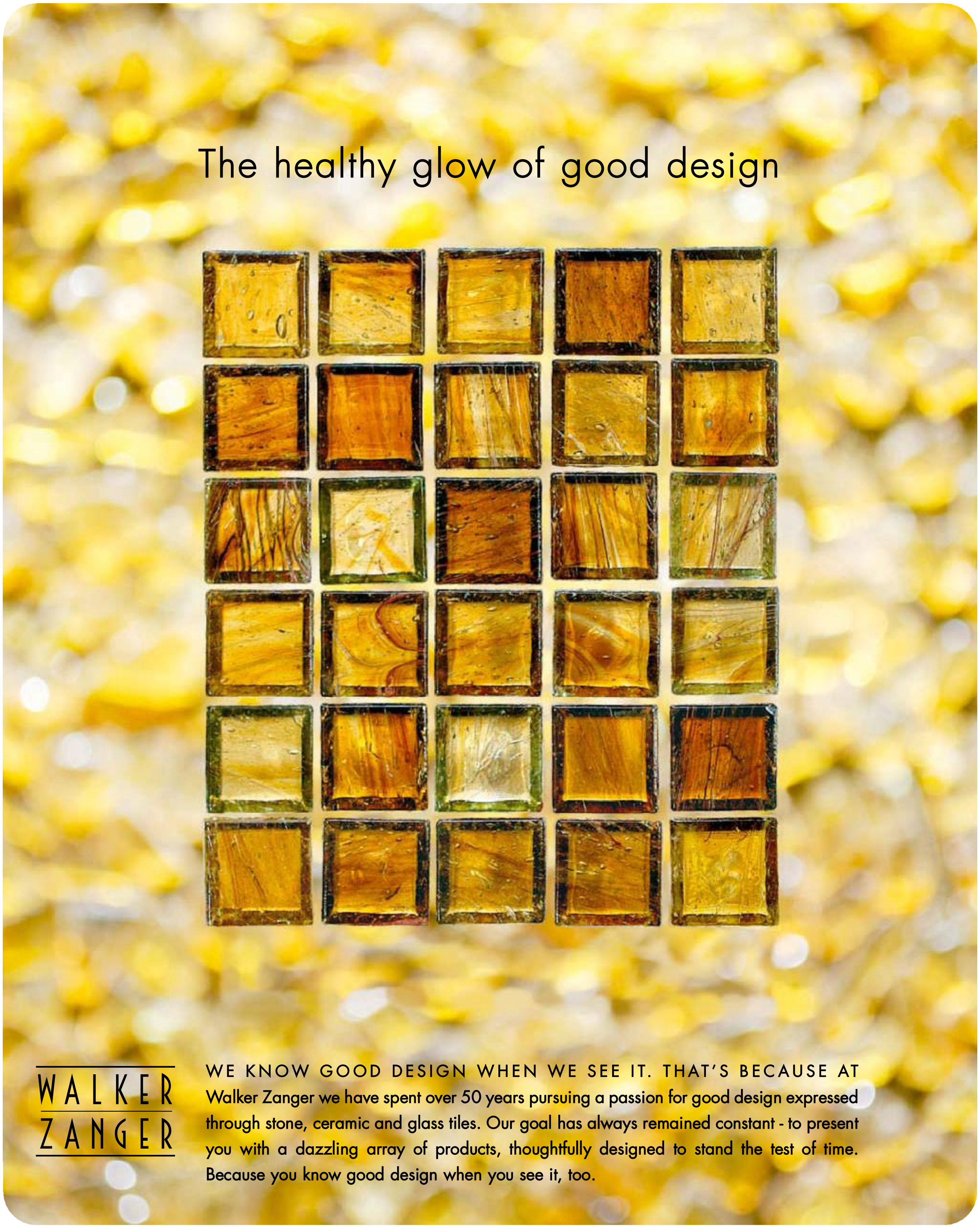
Acoustical integration is arguably the most challenging aspect of transit design. Sound has multiple air- and ground-borne sources—ambient crowd noise, public address announcements, mechanical noise, and track vibrations. Most of the attenuation and mitigation options involve intense architectural and engineering collaboration. "It's a totally integrated process," explains Kenneth Griffin, AIA, DMJM Harris's chief architect for the project. Griffin's team is designing the line's 16 new subway stations and several ancillary structures and is working closely with all the consultants. "We influence each other's strategies," he says.

THE EFFECTIVENESS OF SOUND-ABSORBING MATERIAL IS DEPENDENT ON ITS PROPERTIES AND ITS LOCATION.

For example, FEIS criteria calls for "comfortable and controlled aural environments," in which public address announcements are clearly intelligible. Acoustical engineers from Arup collaborated with the architects and NYCT communications engineers to investigate integrated options. Arup measured the acoustical conditions at existing stations to determine how current public-address systems work and assess the effectiveness of sound-absorbing finishes. They analyzed each link in the chain of sound transmission from the announcer's booth through the cabling infrastructure to the speakers and finally to station platforms, determining that the distortion that so often renders announcements unintelligible is cumulative. Back in Arup's in-house sound lab [RECORD, March 2003, page 149], every factor that either improves or degrades the quality of sound is isolated and evaluated independently, so that the system can be designed and specified as a whole rather the sum of its parts.

To help control reverberant noise from the public-address system, Arup is recommending that the mezzanine and platform ceilings include sound-absorbing elements that are merged with the station architecture. "The effectiveness of sound-absorbing materials depends not only on how much sound they absorb, but also on where the materials are located relative to the noise source," explains Arup acoustical engineer Joe Solway.

The SAS public address system, currently in design development, will include a component for delivering verbal instructions in case of emergency, thus eliminating the less-effective alarm system in use at existing stations. With full-scale mock-ups, the architects are now exploring platform-edge and mezzanine-level "service carriers" that would house the system, along with lighting, closed-circuit TV cameras, and



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cabling, into canopies. These overhead elements will allow contractors to avoid embedding electrical conduit in concrete, thus keeping this critical station infrastructure accessible for maintenance, explains Griffin.

In all aspects of design development, the architects are guided by 12 design principles that consider the interface between architecture and the myriad engineering, life-safety, and urban-design requirements. For instance, one of the design principles calls for a balance between station context and essential "elements of continuity." These are "the physical elements that have a systemwide reference." They are standard planning devices, such as structural grids and modular components, which can be repeated in all the stations to a degree that is practical. Whereas continuity is important to passenger orientation and comfort, it is critical to maintaining structures that are designed and built to perform well for 100 years. Building services, systems, lighting, and graphics must be integrated identically in each station, and the repetition of modular components allows efficient repair and replacement. The office walls of the DMJM Harris/Arup joint venture are plastered with studies showing this integration and design evolution to date.

In addition to the new subway stations, DMJM Harris is designing several ancillary, multistoried structures at street level, which will house exhaust fans and other ventilation equipment serving individual stations and tunnels. The acoustical and mechanical engineers are working to ensure that fans, cooling towers, and handling units are designed with the necessary sound attenuation to reduce noise emission to the exterior and surrounding buildings. These measures become architectural concerns because the mitigation strategies can affect material choice and facade design. As preliminary renderings show, these unoccupied structures will receive the same level of architectural detailing as the subway stations, since their presence will similarly define the surrounding urban fabric.

Sudhir Jambhekar, AIA, principal at New York City–based FXFOWLE Architects, worked on the SAS for three years. Although the firm is no longer involved, the experience led Jambhekar to develop an argument regarding the architect's role in large infrastructure projects, such as the SAS. "Architects assume that there isn't much design opportunity in these building types, but that's just not the case," he insists.

Jambhekar acknowledges that organizational and management hierarchies can be more complicated than those applied to comparable commissions, such as highly specialized institutional projects. Infrastructure projects can take two or three times longer to complete, requiring a commitment of a decade or longer. Architects often work within large teams, which, in addition to the typical consultants, can include a maze of government agencies and regulatory commissions. However, in spite of these challenges, he makes a strong case for architects' involvement: "Infrastructure influences quality-of-life issues more than people think, which is why we should feel obligated to participate." ■

AIA/ARCHITECTURAL RECORD CONTINUING EDUCATION

INSTRUCTIONS

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- **Complete the questions below, then fill in your answers on the next page.**
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QUESTIONS

1. The Second Avenue Subway will provide more access to what area?
a. John F. Kennedy International Airport
b. Central Park
c. the East Side of Manhattan
d. Long Island

2. Which of the following agencies or groups are the official clients of the Second Avenue Subway?
a. the Federal Transit Administration and the Metropolitan Transit Authority
b. the Federal Transit Administration and Manhattan East Side Alternatives
c. the Metropolitan Transit Authority and New York City Transit
d. Manhattan East Side Alternatives and New York City Transit

3. Because the Second Avenue Subway receives federal funding, all design decisions must meet the requirements of which?
a. the Federal Transit Administration
b. the National Environmental Policy Act
c. the Manhattan East Side Alternatives Study
d. the Federal Advisory Committee

4. The Final Environmental Impact Statement considers the potential effect of all except which?
a. best-case scenarios
b. noise and vibration
c. roadway congestion
d. social and economic conditions

5. The approved excavation technologies for the project are all except which?
a. tunnel boring technology
b. cut-and-cover
c. mining
d. water drilling

6. A boring machine usually causes little surface disruption, except when?
a. the existing infrastructure is old
b. the ground above is densely occupied
c. the street is excavated to insert the machine
d. it is used to bore through bedrock rather than soil

7. When tunnels are mined using the "drill-and-blast" method, explosives are detonated sequentially for short periods of time for which reason?
a. to lessen the potential for ground vibration at nearby structures
b. to pace the amount of rock to be removed by bulldozers
c. to keep air flowing through the shafts
d. to divide the excavation spoils equally among the individual conveyor cars

8. An earth-pressure-balance machine is used to perform which operation?
a. bore through bedrock
b. bore through soil
c. remove spoils from the excavation site
d. create curved sections of the subway line

9. The overhead "service carriers" that the architects are designing will incorporate which?
a. a public address system
b. lighting
c. closed-circuit TV
d. all of the above

10. DMJM Harris is designing multistory above-ground structures that will house which?
a. offices for Metropolitan Transit Authority officials
b. ticket vending machines
c. exhaust fans and ventilation equipment
d. maintenance equipment

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Lighting

Designs that move bodies and imaginations

Sidewalks, plazas, highways, bridges: With a few exceptions, infrastructure usually plays the strong but silent type. But no longer are civic engineering works simply taking people from point *A* to point *B*. Designers of architectural lighting are redefining this necessary connective tissue with moments of poetry and delight.

For example, the developer of a Los Angeles apartment building called Met Lofts asked for a piece of art for the exterior of the building. The tech-savvy firm Electroland used the commission as an opportunity to inject a dose of fun and commentary into the streetscape, giving pedestrians control of the lighting sequence on the building's western elevation. It's a cheeky take on surveillance, an activity for the denizens of L.A.'s South Park neighborhood, and a call to animate the sidewalks of the car-centric city.

In the Yangpu District of Shanghai, China, artist Zhong Song deployed lighting design to invite pedestrians to enjoy Wu Jiao Plaza. But his work did not tackle a perceived problem so much as perform surgery on an open wound. A new highway overpass had effectively ruined the plaza, injecting a dark, threatening presence just as factory closures were siphoning people away from the area. By wrapping the overpass in a futuristic curved-metal skin embedded with LEDs (below left), and performing an extreme makeover on the plaza's other features, Zhong transformed the overpass from overbearing to engaging and encouraged Yangpu's remaining residents to repopulate the zone.

The Langeais Suspension Bridge has had no problem in attracting users. Tourists flock to the city, which sits on the banks of the Loire River in France, to visit its famous 15th-century château. As part of the bridge's reconstruction, acclaimed 32-year-old lighting designer Sylvain Bigot cast the bridge in a moody blue, accented by deep shadows and white light. The gestures underscore the bridge's architectural similarities to the château and bring all of Langeais into the tourist experience.

While their makers' motivations differ, these projects underscore infrastructure's artistic potential. As travel between destinations becomes its own event, transportation networks have employed striking new media to create provocative design. *David Sokol*

BRIEFS

Spring is awards season, and this year as usual the lighting-design industry honored its brightest accomplishments and most promising newcomers with a series of prizes. The International Association of Lighting Designers, for example, recognized 20 honorees at its annual International Lighting Design Award Winners program in May. The highest winner—recipient of the association's Radiance Award—was Karou Mende, of Tokyo-based Lighting Planners Associates, for the **Chino Cultural Complex**, in Nagano, Japan. The project is the world's first cultural facility that includes a library, concert hall, and gallery along with an existing train station.

As a counterpoint to the project wins, the Lightfair Innovation Awards teased out the best products from 139 entries. Top of the heap: the **ARC Keeper Arctic 175 HID Backup Ballast** from the Bodine Company, which earned Most Innovative Product of the Year. The product prevents lamp extinction during voltage disruptions by catching and maintaining the arc of one 175-to-200-watt, metal-halide pulse-start lamp for up to two minutes. The ORUS Roadway Luminaire from North Star Lighting, Luxeon Rebel from Philips Lumileds, and ALTO II T8 Lamps from Philips Lighting Company also won special honors for design and technical excellence. The Illuminating Engineering Society New York Section presented Cline Bettridge Bernstein Lighting Design with its Award of Excellence for **7 World Trade Center**, citing the firm's clever masking of the transformer walls at the building's base. New York City locals also paid attention to another June event, honoring the designers involved in an even more substantial Big Apple landmark: Kevin Adams won a Tony Award for best lighting design of a musical for *Spring Awakening*, a first-time use of CFLs on Broadway; Brian MacDevitt, Kenneth Posner, and Natasha Katz won best lighting design of a play for the Tom Stoppard trilogy *The Coast of Utopia*. *D.S.*

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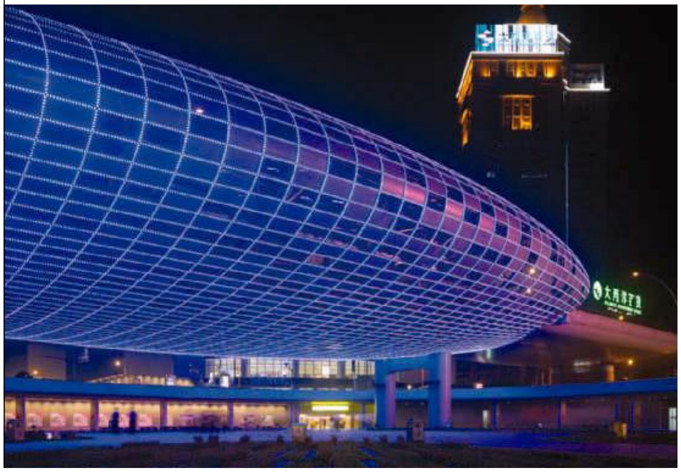

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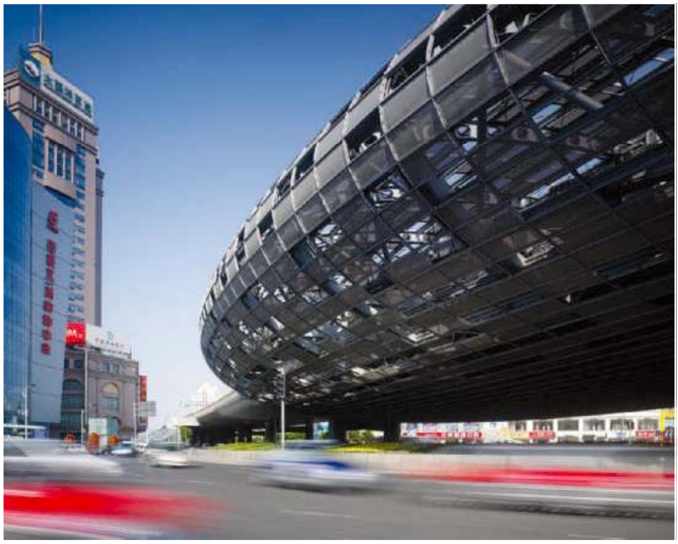


To reanimate a Shanghai neighborhood, **Zhong Song** wraps an obtrusive highway overpass in metal and light

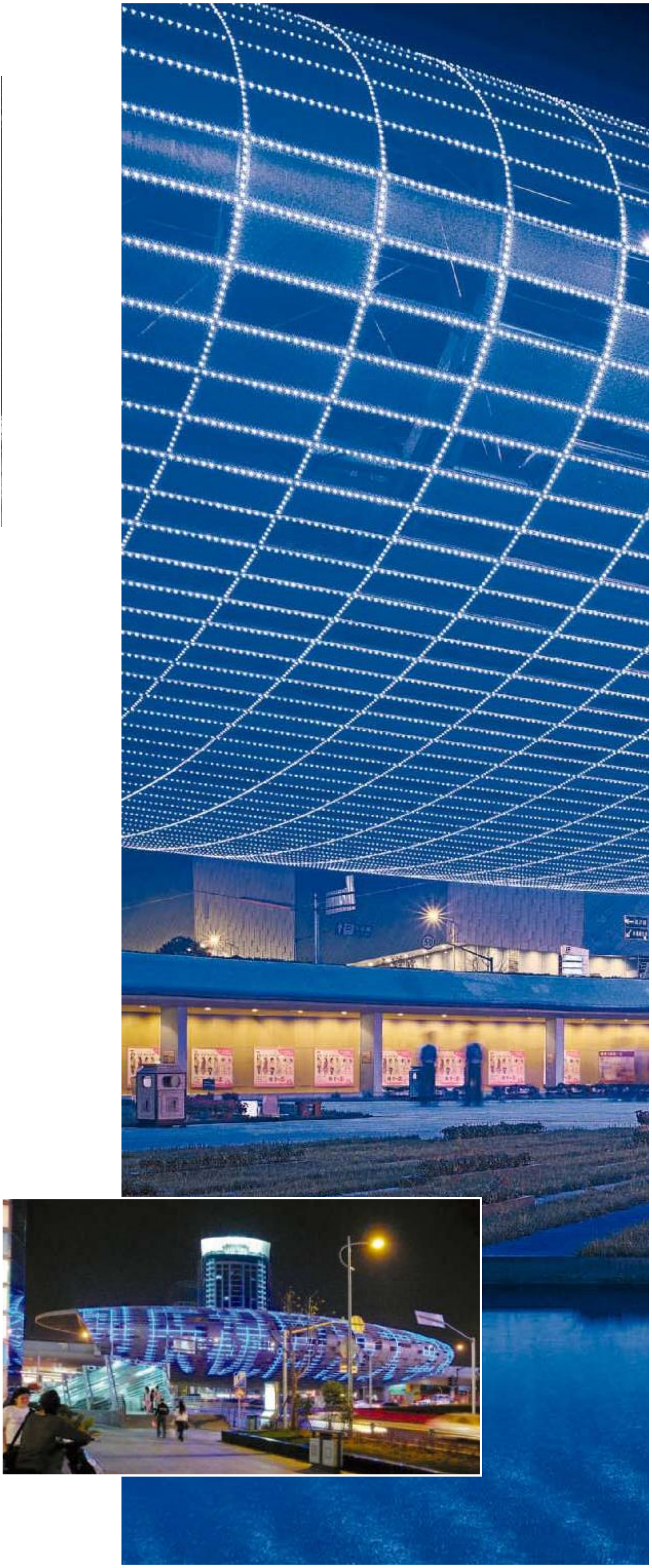
By Andrew Yang

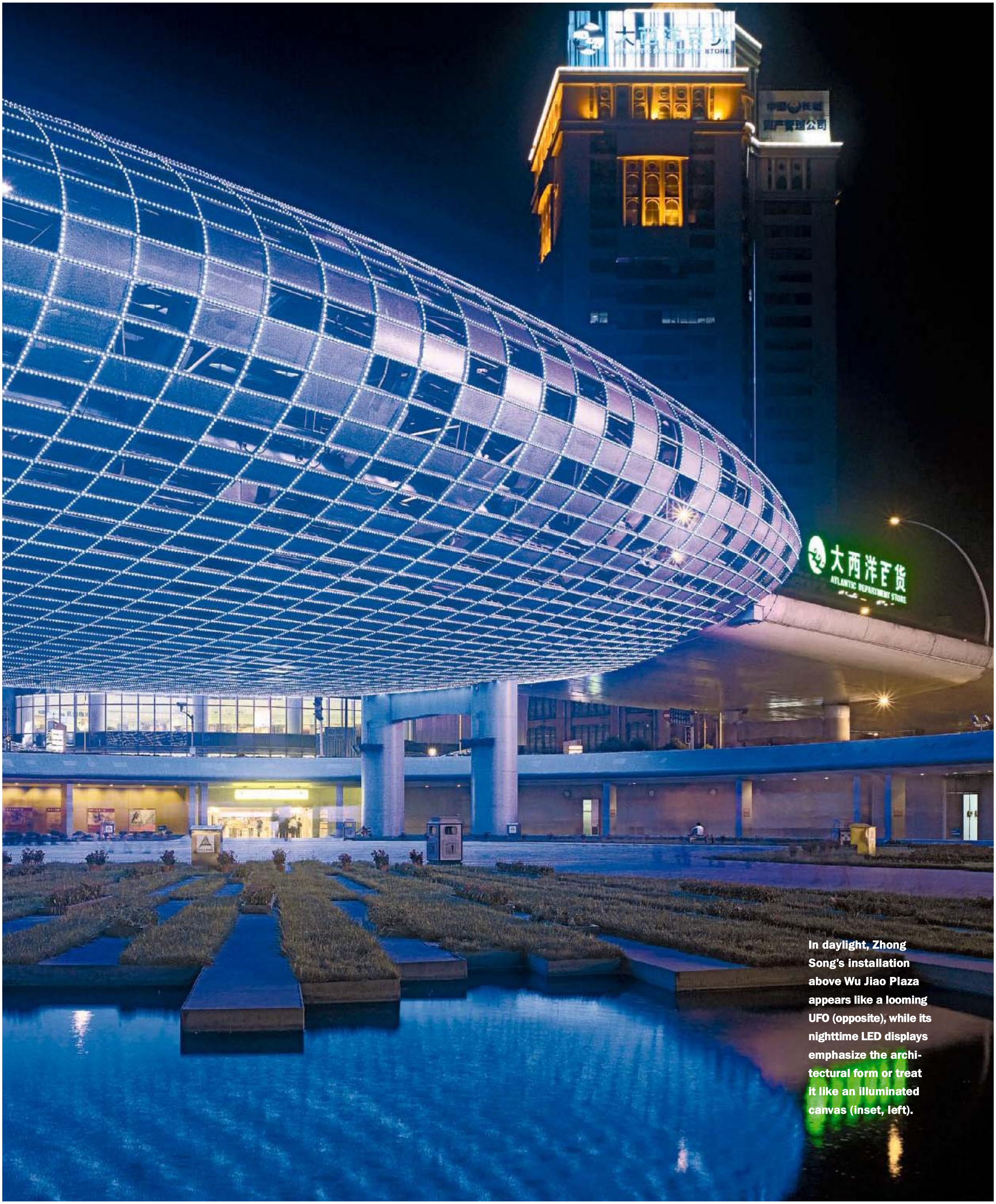
It's never easy to make transportation infrastructure look good. In the United States, typical strategies include planting flowers within a rotary; erecting banal, noise-blocking barriers along freeways; and in many urban areas, doing nothing at all. But in China, at Wu Jiao Plaza in Shanghai's Yangpu District, the artist Zhong Song created an installation that dynamically melds architecture with lighting.

The Yangpu District was until recently a thriving manufacturing neighborhood. But around 2003, factories began abandoning the area for less-expensive industrial zones in the countryside. Though unrelated to the loss of manufacturing facilities, the city of Shanghai started constructing at about the same time a series of roadways to connect different districts. One such project included a new highway overpass bisecting the center of Yangpu and one of its main public spaces. The underbelly of the overpass cast a dark shadow (literally and metaphorically) on Wu Jiao Plaza, a formerly inviting gathering place.

Andrew Yang is a design journalist currently based in Shanghai. He serves as the design consultant for 100% Design Shanghai, the third edition of the annual furniture and interiors fair that also takes place in London and Tokyo.

Project: *Wu Jiao Plaza, Yangpu District, Shanghai, China*
Design: *Zhong Song Design Consultancy*
Architect: *Jing Ye Design and Research Institute*
Lighting: *Lai En Lighting Consultants*

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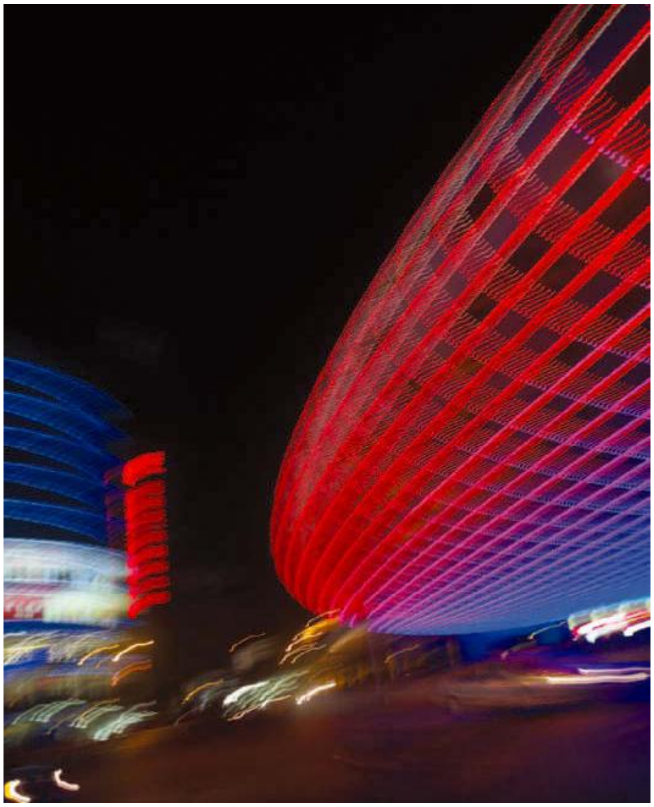
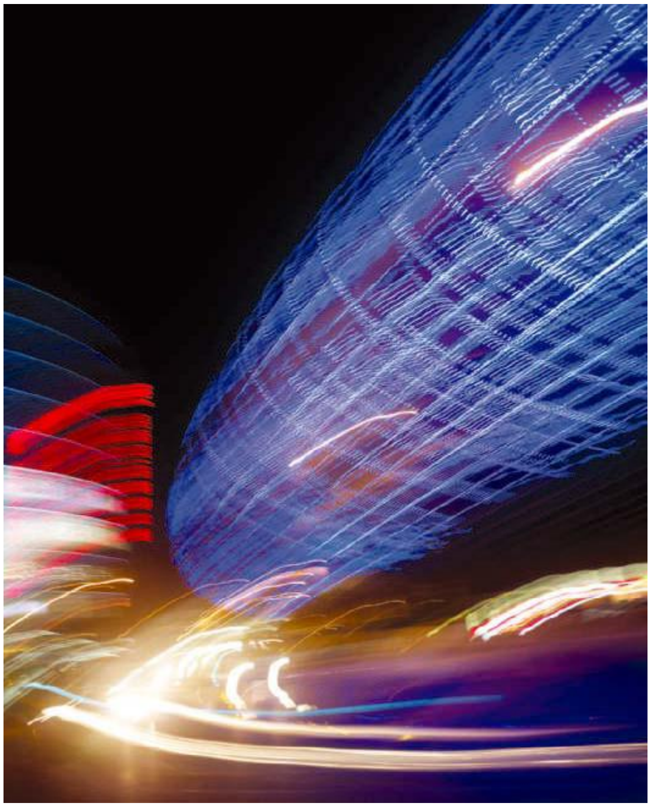
ATLANTIC DEPARTMENT STORE

In daylight, Zhong Song's installation above Wu Jiao Plaza appears like a looming UFO (opposite), while its nighttime LED displays emphasize the architectural form or treat it like an illuminated canvas (inset, left).





Though inspired by the way his installation reflects changes in daylight, Zhong Song's color-changing LEDs mimic the lights of nighttime urban activity (above).

To rectify the situation, local government officials decided to spruce up the intrusion. So in 2003, they hired Zhong to design a sculpture for Wu Jiao Plaza based in part on a piece, *Light of the East*, that he had completed in Pudong in 2000 with the artist Chen Yifei. One of Zhong's large, architectural-scale sculptures, *Light of the East* is a giant sundial made of a needle piercing a disc. But for Yangpu, he proposed that the government reinvent the urban fabric of the area, not just add another monument to the plaza.

The site is not far from Fudan University and several colleges, explains Zhong. "The municipal government wanted to make it an active space, but the highway overpass splits it in two," he says. "The idea was to bring it back to the way it was"—a place of pedestrian movement and outdoor activities.

Zhong engaged the site's knotty condition. "There are five roads leading to the plaza, and then a highway overpass on top, and a subway line underneath," he continues. "There are three different levels of infrastructure, creating a complex fabric that affects the pedestrian nature of the area. So, the question was, how do we add the pedestrian element so people will animate the five different streets?"

To accomplish this task, the artist enveloped the 105-foot-wide overpass in an oval steel frame clad with aluminum. Measuring 348 feet long, 157 feet wide, and 82 feet tall, it cloaks cars speeding along the overpass.

"The government asked me to do a sculpture initially," Zhong says. "But I told them we need to do it differently. So we made it look like a spaceship, a UFO," he explains. The steel-and-aluminum armature glistens in sunlight, while its skin appears to change from gold to silver under a cloudy sky. Inspired by these shifts, Zhong devised a system of Erco-controlled LEDs, arranged in a grid around the structure, and choreographed them to project an array of changing colors at night. Eventually, artists will be invited to program different lighting environments into and onto the installation's large curved surface.

By making the underside of the overpass a more attractive space for pedestrians, Zhong hopes to draw visitors into the plaza. To activate this interstitial zone, he also relandscaped pedestrian circulation, removing unnecessary obstructions such as poorly placed trees and planters, and regulating print advertisements so they are less graphically prominent. His office also redesigned subway entrances so they are glass-encased steel tubes shooting out diagonally from beneath the ground, which echoes the sci-fi character of the installation suspended above the plaza.

The scope of the project is expansive and continues to grow. The plaza hosts a temporary stage with bleachers for concerts and other occasions, for example. "We hope this will be a space for people," Zhong says. Future plans include projecting light onto adjacent buildings and programming it to accompany the event of the moment. That way, Zhong adds, "The people activate the plaza and it becomes a real social space."

Emphasizing the effects achieved, not the tools used, is part of Zhong's approach to art. As he notes, "When we watch a movie, it does not matter what movie projector is used. What we're watching is more important." ■

ONLINE: To view additional images, see a complete list of sources, and to rate this project, go to ***architecturalrecord.com/lighting/***. Submit your lighting project to ***construction.com/community/gallerylist.aspx***.

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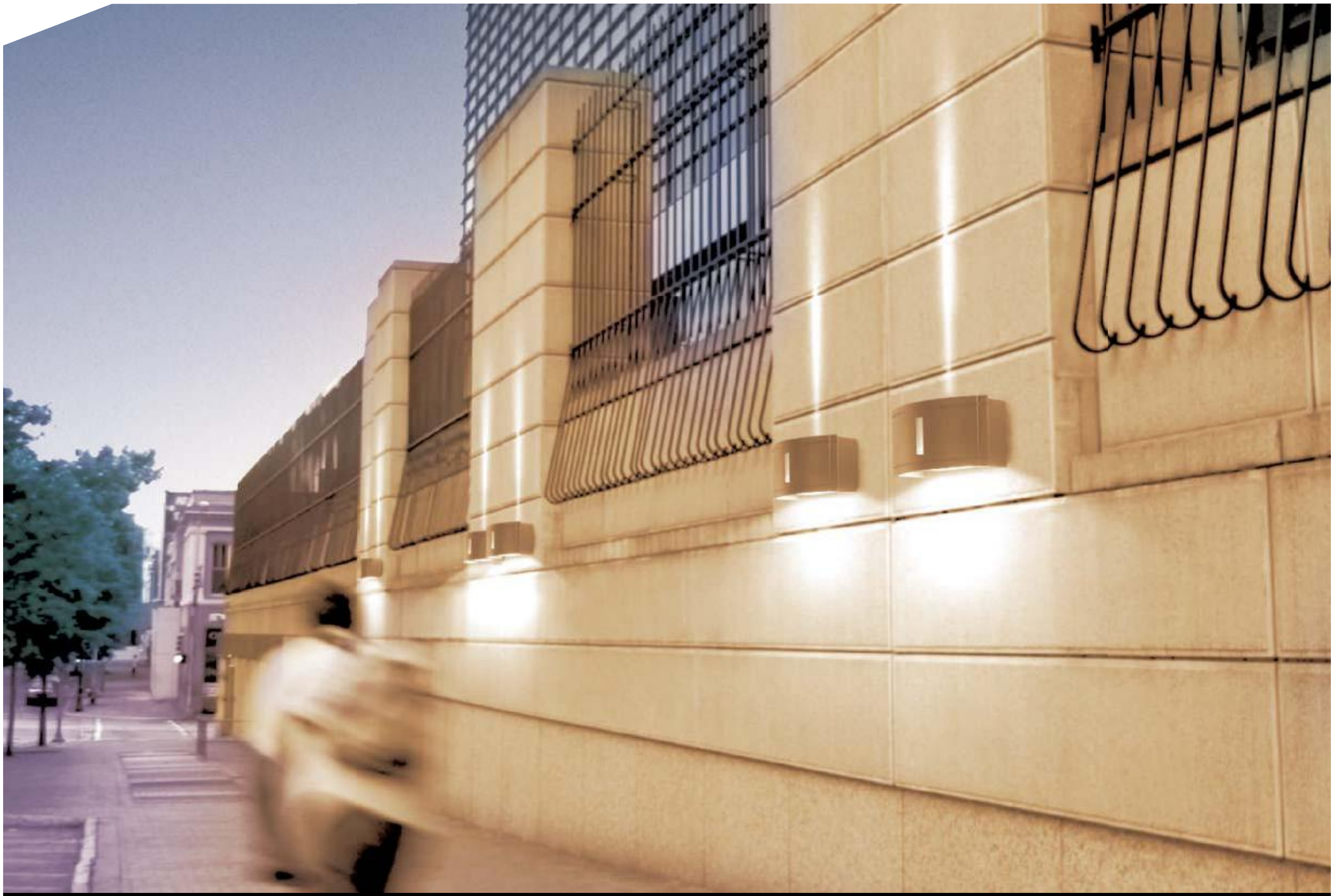

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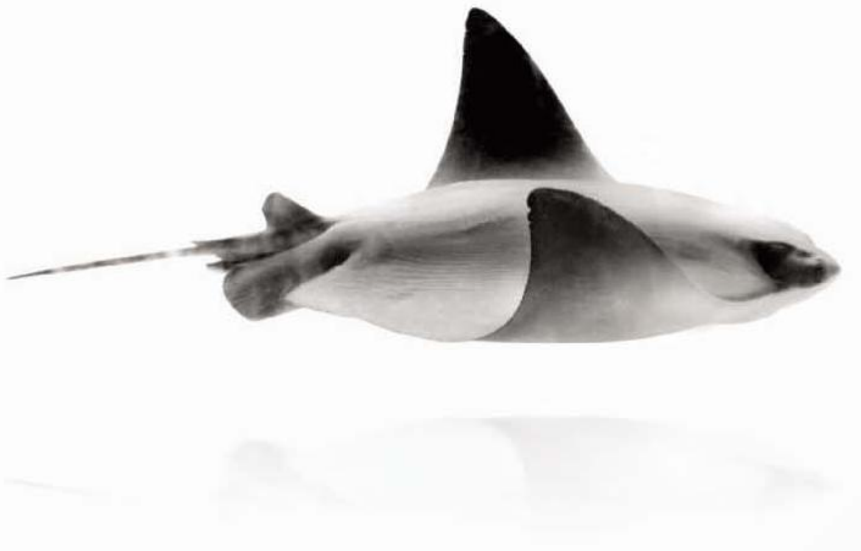

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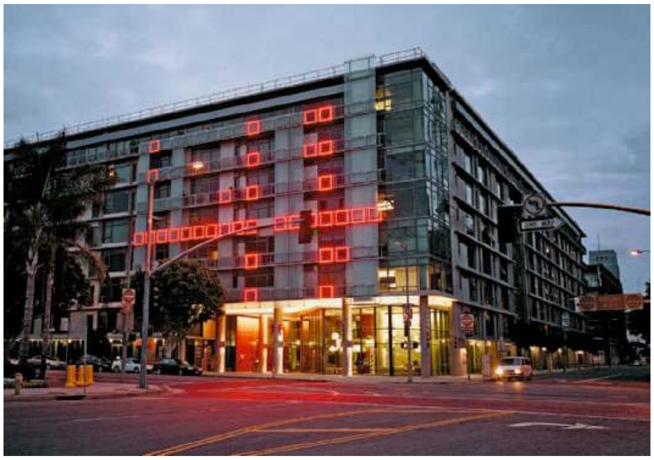
Electroland turns an apartment-building facade into a billboard for pedestrian movement

As pedestrians approach the Met Lofts lobby, they interact with an illuminated sidewalk matrix (opposite). A grid of LED squares on the building's west facade recreates lighting patterns people produce (below) or random designs (below right).



By David Sokol

To the designers at the Los Angeles–based firm Electroland, modern life is a video game. Partner Damon Seeley, who founded the firm with Cameron McNall, expands on the metaphor: "There's a vast network of electronic information surrounding us, and we're navigating and participating in it all the time."

That viewpoint has informed the work of Electroland since its founding in 2001, when McNall and Seeley collaborated on the installation *RGB* for the reopening of SCI-Arc. For that project, they mounted lights in 81 windows of the architecture school's new home, a converted train depot, and people could illuminate them by calling a particular number on their cell phones and using their keypads to control the sequence of red, green, and blue. The communication device effectively became a joystick for controlling architectural and urban space.

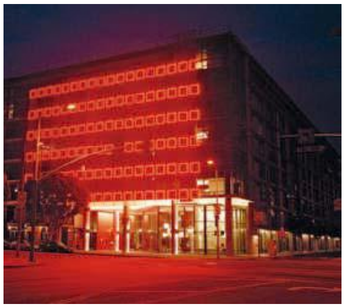
The response to *RGB* was overwhelmingly positive, Seeley remembers, and the work grabbed the attention of local real estate developers in particular. "For them, it's really about enhancing the excitement of the place they are trying to make," Seeley says. Among Electroland's suitors was Forest City, which invited the firm to compete for a Percent for Art project for Met Lofts, a seven-story apartment building designed by architecture firm Johnson Fain and planned for the South Park neighborhood of Los Angeles.

Electroland won the commission in October 2002, and its work, entitled EnterActive, was completed concurrently with the building in 2006. The project offers a fresh translation of McNall and Seeley's perception of the video-game world: Instead of cell phones, EnterActive uses passersby themselves, transforming them into actors in an electronic game board.

The installation comprises two main elements. The first is an array of electronic tiles that sits just outside the entrance to the Met Lofts lobby and serves as the interface with pedestrians. Electroland set a riser system into the surrounding concrete, then placed a grid of 176 16-inch-square tiles within it. Each tile is a sandwich of fritted glass and plastic that holds 96 red LEDs and has four compression sensors and a microcomputer on its underside. When someone steps on a tile, the sensors and microcomputer send data to a master computer located in the lobby. That computer in turn signals the tile to illuminate. A pedestrian can stroll across the array like Michael Jackson singing "Billie Jean," the sidewalk lighting up with each movement.

Or he or she could choose to land on a "trigger tile," a randomly placed illuminated square that, when touched, initiates one of five patterns (such as a twinkling field or a spinning circle of light) that decorate the entire matrix. "The master computer looks at the arrangement of people on the tiles holistically, then decides which illuminated tiles should be turned off," Seeley explains. The result is a playful give-and-take between man and machine: A participant can "push" the twinkling field out of his way, leaving only darkened tiles in his wake, or he can discover a circle of light spinning around him.

Besides feeding back to the tile array, the master computer links to EnterActive's second major component: a grid of illuminated squares mounted on the building's west elevation. While the facade display is more truncated than the sidewalk array, Electroland's proprietary software translates the game board's human movements and computerized patterns into supergraphics flashing on the side of the apartment building. Seeley says that players detect the correlation between themselves and the building face, and understand their influence on the urban landscape. Observers do, too, because "there's something very human about the motion [on the illuminated grid]," he says, "of the way people start and stop and hopskotch on it. It's very hard to fake that with a computer animation or preprogrammed playback."



Seeley adds that he and McNall also took care to integrate EnterActive with its host. The facade installation, for example, echoes the fenestration of Johnson Fain's design. Even more pragmatically, the building includes all the necessary conduit for connecting the installation to the master computer, and each floor contains a connection point for linking the exterior wires to the interior conduit. The vertical grid itself comprises squares of 168 LEDs mounted behind acrylic windows and framed by aluminum extrusions, which slide into bracket-mounted rails.

EnterActive is enjoying the same reception as its SCI-Arc forebear. As people pour out from an evening event at the nearby Staples Center, for example, the installation inevitably experiences a flurry of activity. While the artwork "gets back to this idea of a vast network of information out there," Seeley says, "our motivations are really about creating fantastic experiences for people," especially in Los Angeles, where public spaces could benefit from a sense of whimsy and play.

Playful for the pedestrians, sure. But isn't EnterActive a recipe for insomnia for Met Lofts' residents? Electroland solved that, too. Although the lumen output of the facade-mounted LEDS is five times that of the sidewalk interface, the aluminum extrusions holding them in place shield the diodes' red shine from apartment dwellers' eyes. ■

David Sokol is a freelance writer and frequent contributor to RECORD.

ONLINE: To view additional images, see a complete list of sources, and to rate this project, go to **architecturalrecord.com/lighting/**. Submit your lighting project to **construction.com/community/gallerylist.aspx**.

Project: *EnterActive, Los Angeles*
Installation designer: *Electroland*
Programming: *Kevin Tanaka*
Architect: *Johnson Fain Partners*

PHOTOGRAPHY: © ELECTROLAND

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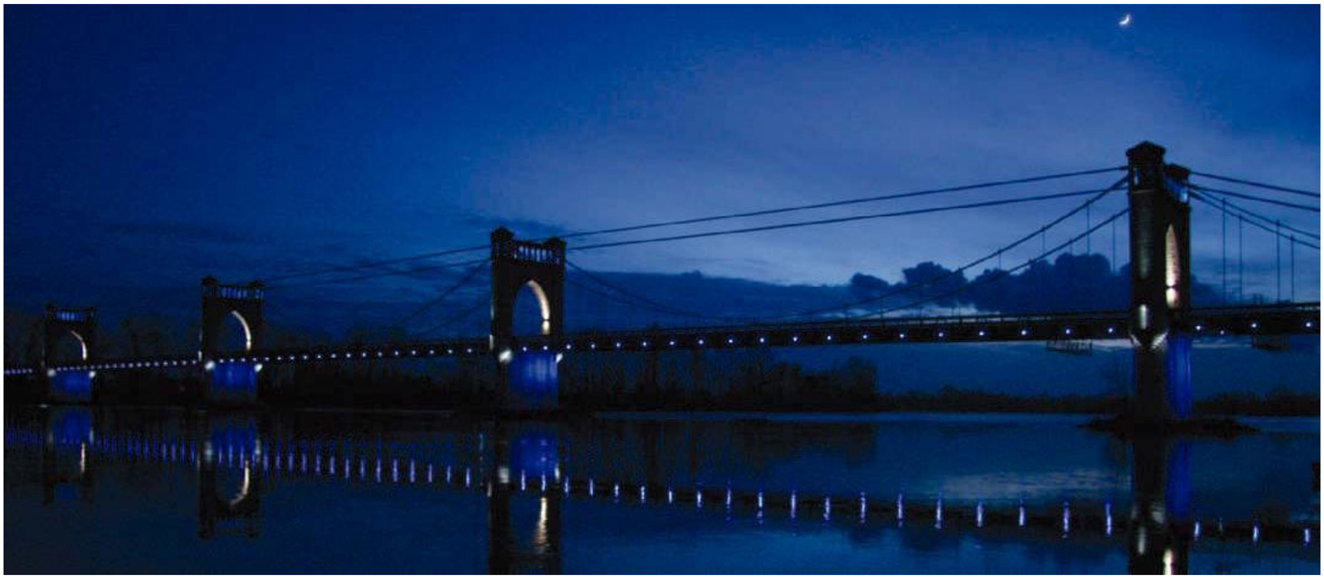


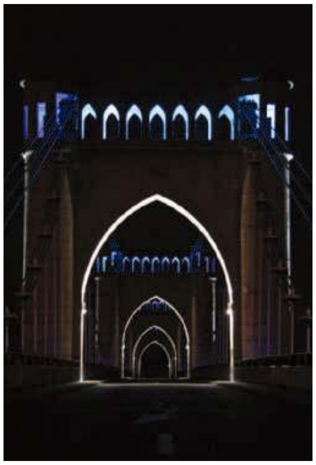
For a medieval French city, Sylvain Bigot dresses the **Langeais Suspension Bridge** in majestic blue light

By Robert Such

Sylvain Bigot jokes, "I'm the bridge lighting designer." Bigot, principal of Neo Light, a firm in Joué-lès-Tours, France, has illuminated the Saint Satur Viaduct and the Pont de Montrichard, for which he was awarded first prize in the 2004 Light Competition, which is overseen by the French Ministry of Culture. This year, he earned the same honor with his scheme for the Langeais Suspension Bridge over the Loire River.

A bridge has connected the French town of Langeais to the municipality of Chapelle-aux-Naux since 1849. Its current incarnation has spanned the Loire River since 1950, yet recent reconstruction work was required to correct problems with the structure. Original builders Baudin-Châteauneuf replaced structural elements in the deck and the suspension cables in 2005. Concurrently, government officials held an open competition to implement a lighting scheme, for which Bigot proposed blue atmospheric lighting and bold shadows to highlight the bridge's form and texture. He won the job in May 2006, and realized the design six months later.

Bigot negotiated two inspirations in his work. In response to the Loire's calmness, he determined to create "a very quiet image of the bridge," he says. The architecture of the structure, itself inspired by the renowned 15th-century Château de Langeais, also influenced his direction. Four pointed arches, for example, are a direct reference to the château and provide an impressive entrance to the town. "Going through the entry," Bigot says, "is like going through the château." His choice of predominantly blue lighting—"the color of royalty"—reinforces the effect, and mimics the blue of the water at sunrise. To pick out the five decks suspended between the bridge's four reinforced-concrete towers, Bigot installed 150 blue, single-watt LEDs on the decks' sides.



White light crisply outlines the Langeais Suspension Bridge, while blue emphasizes its bulk.

At the top of each tower, a gallery of narrow arches is lit with metal-halide lamps equipped with blue filters. Suspension cables, however, pick up only blue spill from light hitting the gallery arches; Bigot explains that highlighting the cables would have been too commonplace a gesture, or "déjà vu."

Up-down metal-halide LED luminaires placed 11 feet above the roadway act as street lighting and also brighten each tower archway. In similar double duty, Bigot fixed white LED floods to the underside of the deck to accent the turrets' circular bases, and used a narrow-beam white uplight to graze the turret wall, revealing wall texture. Wide-beam metal halides underneath the deck bathe the bridge supports in blue light.

Fear of déjà vu propelled Bigot to add a temporal finesse to the bridge. During the week, a timer switches off the white turret lights. Full illumination on Saturdays and Sundays breaks the visual monotony and welcomes Langeais's numerous weekend visitors.

Or, perhaps, educates them: Bigot calls his design for the Langeais "a dramatic and poetic scene," which he attributes to its play of shadows and light. "I like the light," he says, "but I prefer the shadow. It's necessary to understand the volumes and the forms." ■

Robert Such writes about and photographs design for publications around the world.

ONLINE: To see a complete list of sources, and to rate this project, go to **architecturalrecord.com/lighting/**. Submit your lighting project to **construction.com/community/gallerylist.aspx**.

Project: *Langeais Suspension Bridge, France*
Client: *Conseil Général d'Indre et Loire*
Lighting: *Neo Light*
Contractor: *Citéos*

PHOTOGRAPHY: © SYLVAIN BIGOT

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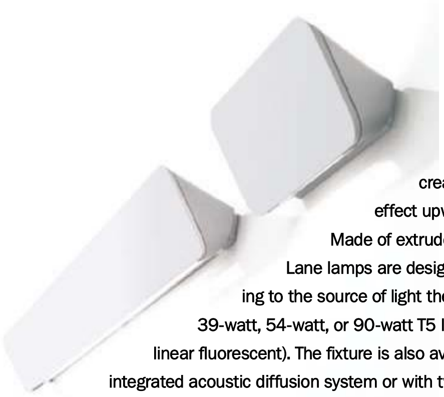
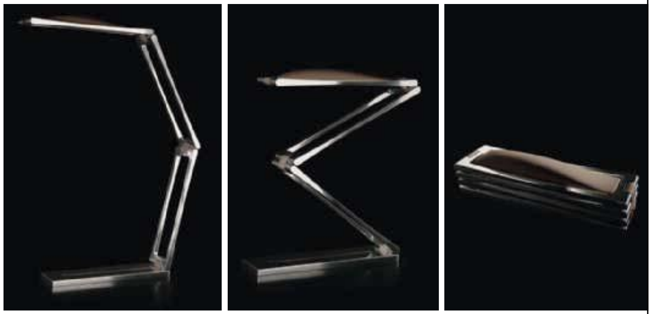
Lighting Products

This year marked the debut of the **biennial Euroluce exhibition** at the new Rho-Pero fairgrounds in Milan. Exhibitors made the most of the occasion **by creating fantastic booths** that put clever and often futuristic fixtures center stage. *Rita Catinella Orrell*



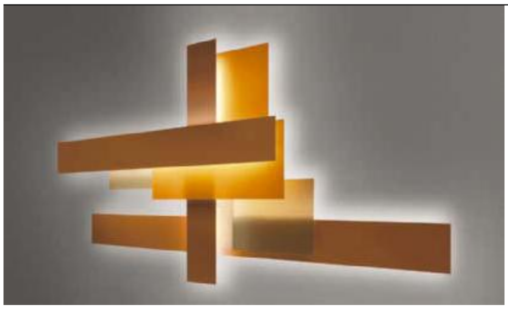
◄ Lane of light

Lane, designed by the Swiss-Argentinean designer Alfredo Häberli, is a new family of linear lamps that creates a soft, diffused lighting effect upward and downward on the wall. Made of extruded and die-cast aluminum, Lane lamps are designed in various lengths according to the source of light they contain (150-watt halogen, 39-watt, 54-watt, or 90-watt T5 linear fluorescent, or 54-watt T5 linear fluorescent). The fixture is also available in a version with an integrated acoustic diffusion system or with two LED spots for direct light for reading. Luceplan, New York City. www.luceplan.com **CIRCLE 209**



▲ Missing link

In addition to a new fixture by Foster+Partners, Nemo (the lighting brand of Poltrona Frau Group) introduced the Chain desk lamp by Ilaria Marelli. The easily foldable lamp offers widespread LED illumination, the intensity of which can be regulated by a stroke of a finger. With a body and base of aluminum and joints made of fiber-strengthened plastic, Chain is available in a polished or pearl white aluminum finish. The light measures 21.7" x 27.5" when fully open (left) and 2.75" x 10.6" when closed (right). Illuminating Experiences, Highland Park, N.J. www.nemo.cassina.it **CIRCLE 211**



▲ Fields of light

Fields, designed by Vicente Garcia Jimenez, was inspired by the aerial panorama of the fields in the designer's homeland of Mancha, Spain. The lamp is composed of white/ivory or red/orange methacrylate and aluminum sheets that diffuse the light and create a range of lighting effects on the wall. Fields is ideal for illuminating both large and small areas, according to the number of elements used. Lightology, Chicago. www.foscarini.com.it **CIRCLE 214**

◄ Secret garden

The Skygarden pendant, designed by Marcel Wanders for Flos, was inspired by an antique decorated plaster ceiling in the designer's former home that he literally took with him when he moved. The lamp features a plaster body with a "hidden" textured decorative pattern on the inside. The exterior is finished in opal gold, or matte white, black, or rust paint. Skygarden is available in 35" and 24" sizes in 250-watts and 150-watts, respectively. Flos USA, Huntington Station, N.Y. www.flos.com **CIRCLE 210**

► Bioluminescence

Flora, designed by the London-based architecture and design firm Future Systems, is an organic interpretation of the traditional arch floor lamp. The lightness of the lamp's polished aluminum body is made possible by the latest hydroforming technology used for bicycles and racing equipment. An additional component frees the lamp from the base, allowing it to be installed on any horizontal surface. A diffuser in opal blown glass produces a soft light source. FontanaArte, New York City. www.fontanaarte.it **CIRCLE 212**

▼ Flexible tubular fixture

Initially designed as a lighting solution for subways, stations, and parking lots, the tubular iSign fixture also works well in spaces ranging from offices to retail, including exterior-interior borderline installations. iSign is available in surface-mounted, wall-mounted, horizontal and vertical suspended versions, and with individual or double modules. The fluorescent T16 lamp comes with a polycarbonate exterior in 3" or 4.3" diameters, two lengths, and monolamp or bilamp versions, including an RGB version with DALI control gear. iGuzzini, Recanti, Italy. www.iguzzini.com **CIRCLE 213**

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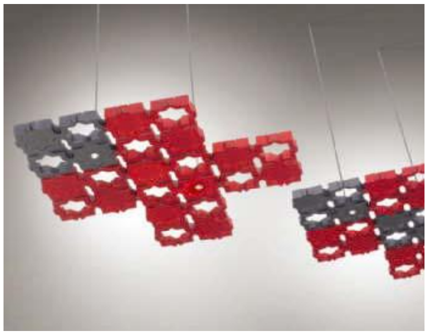
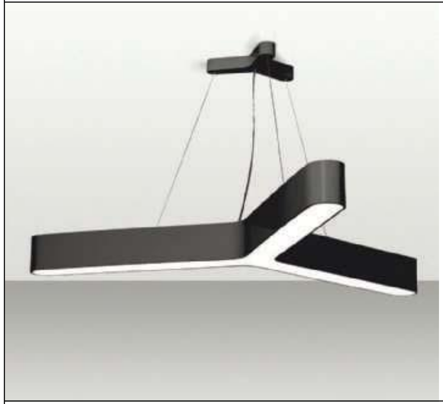
Lighting Products

While not every exhibitor displayed LEDs at this year's **Lightfair International**, held in New York City in early May, **the energy-efficient systems were the stars of the show**. Below we highlight both LED and non-LED standouts. *R.C.O.*

► Modular mindset

Marrakesh is a new modular LED lighting system that is ready to ship from Mindspring. Inspired by Mediterranean Art, the modularity of the energy-efficient system allows for ease of assembly and artistic freedom. An unlimited number of modules can be combined, giving the designer total flexibility in terms of size and shape; for example, stacking two completed units can create 3D designs. The completed unit can be suspended from the ceiling or wall or be incorporated into the flooring. Mindspring, Taipei, Taiwan. www.mindspring-lighting.com **CIRCLE 215**



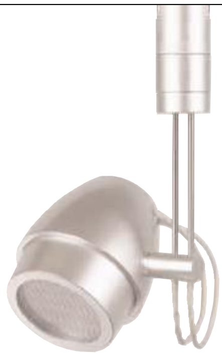


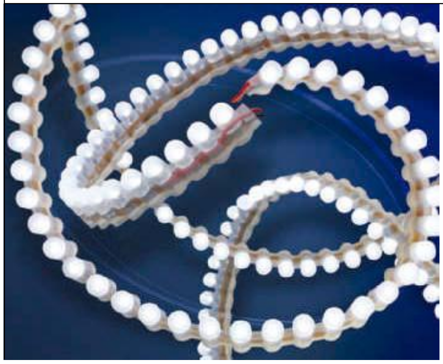
◄ Gears of light

The three-armed Gear 3 fixture, designed by Xenon Architectural Lighting and Carsten Kiselowsky, works well solo or in a series. The light features an aluminum body, a white or gray finish, and a satin-finished acrylic cover. Three 14-watt dimmable lamps provide a gentle, even illumination of the surrounding area, while the three-point cable suspension and the transparent 79"-long power cable make adjustments simple and flexible. Xenon Light, New York City. www.xal.com **CIRCLE 216**

► Small profile track

Tangent is the smallest profile line-voltage track-lighting system on the market, according to Lightolier. Tangent combines extruded aluminum and clear polycarbonate into a low-profile track system that utilizes low voltage MR16 and T4 bipin lamps, as well as line-voltage ES16 and G9 lamps. Ideal for commercial, retail, and residential applications, Tangent can be used in straight run arrangements or bent into architectural curves. Unlike other systems, Tangent's "side-by-side" busbar design allows the track to be surface-mounted flush to ceilings and walls. Lightolier, Fall River, Mass. www.lightolier.com **CIRCLE 217**

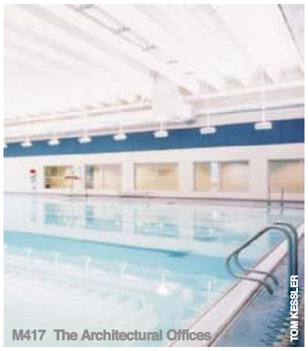




◄ Edgy new LED modules

Linearlight Multi Flex LED modules are ideal for edge lighting transparent materials and provide a solution for precise backlighting of complex contours. The modules have a service life of 50,000 hours and provide an alternative choice for indoor or outdoor linear applications such as cove lighting, refrigeration cases, and pathway marking. The LEDs are also suited for lifesaving/rescue sign lights and commercial signs, as well as marking contours such as escape routes, borders, and stairs. Osram Sylvania, Danvers, Mass. www.sylvania.com **CIRCLE 218**

Versatility


M417 The Architectural Offices
TOM KESSLER

T204 SmithGroup
JUSTIN MACONOCHIE

M152 Brandston Partnership, Inc.
AKER/ZVONKOVIC

Reliability

M412 Gresham Smith
CHRIS CUNNINGHAM

F115 Fisher Marantz Stone
ROB PEPPLE

M152/M454/H454 HOK
ROBERT PETTIS

Durability

F502 Fletcher Thompson
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T104 Walter Anderson
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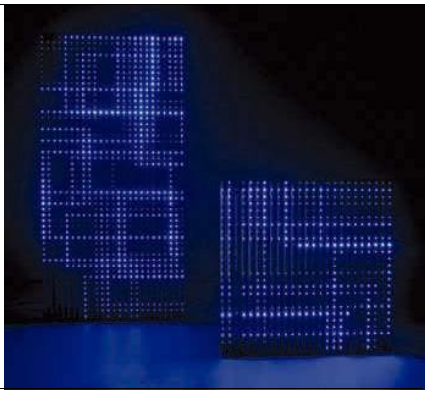
Lighting Products Lightfair International

► Finding the way in the dark

At the show, Philips launched a range of LED fixtures including a Linear luminaire (above) that can illuminate the facades and surfaces of buildings, bridges, monuments, and other structures with curtains of light. With 55 to 65 lumens of light output, StumbleLight (right) is a motion-activated night guiding light designed to turn on when a hotel guest steps out of bed, preventing the need to turn on bright room lighting that could disrupt a full night's sleep. Philips, Somerset, N.J. www.philips.com **CIRCLE 219**

► LED panel displays

The LC series is a semitransparent, modular system of LED panels, ideal for displaying film, digital images, and graphics for stage, TV studio, and commercial applications. The extremely bright units offer true RGB possibilities and feature a calibration system that ensures output is always balanced and uniform. The 39.4"-long system is 4.3" wide and comes in a 39⅓" or 79" heights. A Genlock feature prevents light-flicker in TV applications, and units can be evenly joined for a seamless image. Martin Architectural, Sunrise, Fla. www.martinarchitectural.com **CIRCLE 220**



◄ Health-care chart/reading lights

Circadian LED Series is a new family of LED nightlights and chart/reading lights from Cooper Lighting that offer an energy-efficient, low-glare solution for aiding night-time navigation. The night-lights feature white, red, or amber LEDs, that bring low-level illumination to small areas without disturbing sleep. Recent studies have found that these colors can complement a person's circadian rhythm, says the manufacturer. Cooper Lighting, Peachtree City, Ga. www.cooperlighting.com **CIRCLE 221**

► Quicker install for back lighting

The Tetra PowerGrid LED lighting system addresses the need to simplify and speed the installation of energy-efficient, high-brightness LEDs in large-scale back-lighting applications such as cabinet and box signs. The system features an easy-to-handle, interlinking module design. Lasting up to 50,000 hours, the system delivers four times the rated life of a standard T12 HO fluorescent systems (12,000 hour median life rating). Available prewired, it also consists of fewer parts than standard fluorescent systems. Lumination, Cleveland. www.led.com **CIRCLE 222**

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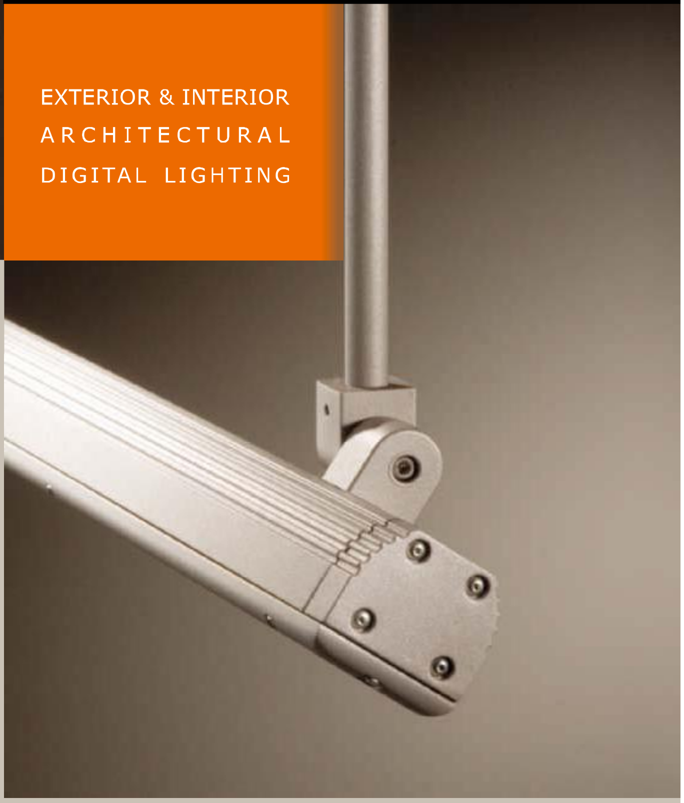

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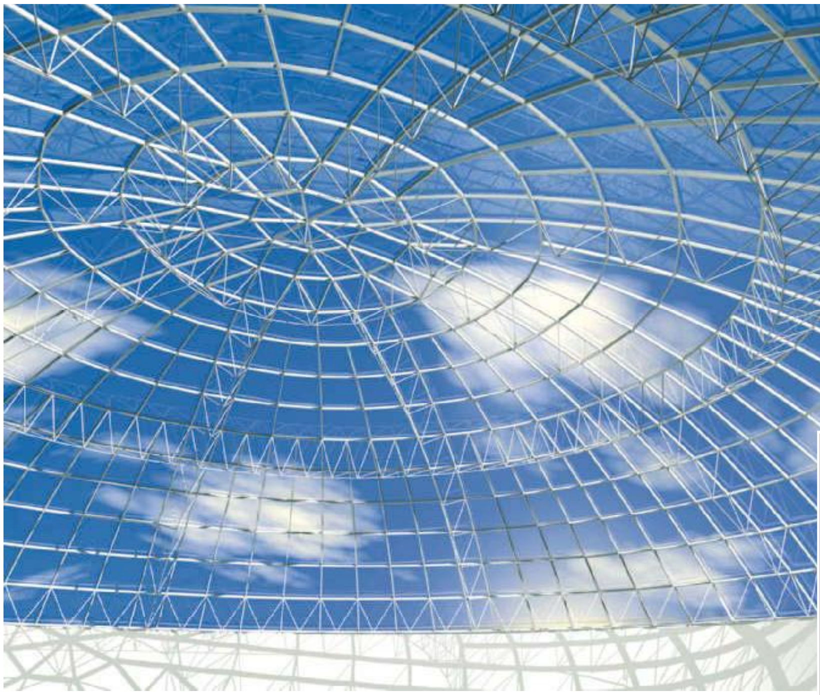
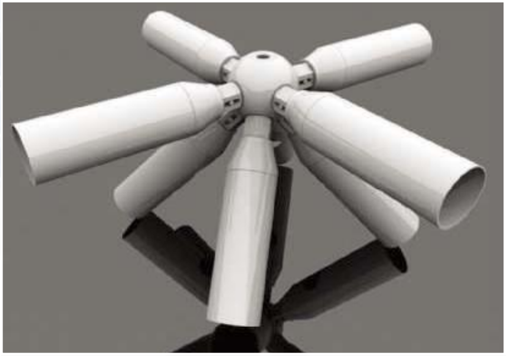
Product Focus

Glass & Glazing

Our roundup this month includes **glass partition systems, a blast-resistant curtain wall, and slabs made from 100 percent recycled glass.** For the latest glass and glazing products and technologies, visit **GlassBuild America,** held this year from 9/10 to 9/12 in Atlanta. *Rita Catinella Orrell*





A rendering showcases the single-layer trapezoidal geometry of the dome (above). The enclosed dome opens up the casino's pool area to the sky (above right). Novum's KK-System makes up the 3D ribs for the structure (right).

Edge-clamp glass system and other technologies lighten up a casino's glass dome

Working with architectural structure and cladding specialists Novum Structures was a safe bet for the architects of an extension to Harrah's Casino and Resort in Atlantic City, New Jersey. Novum, a full-service specialty contractor with almost 1,300 projects under its belt in the U.S. alone, worked with project architects Friedmutter Group to engineer and design a dome above a pool area that would be as transparent and economical as possible, while working within a tight time frame. Located on the New Jersey coast, the casino's dome needed to meet codes for both hurricane-force winds and heavy snow loads. "I don't remember having to look at both in the same project before," says Novum president Ian Collins.

The resulting design is a 208'-wide and 50'-high dome that is nearly seamless to the sky above. Normally, such a large span would require a double-layer support structure with a heavy glass skylight system superimposed over the top. To avoid this situation, Novum used the glass structurally and utilized its BK-System of structural components which gives single-layer capability. The system was used along with Novum's KK-System, which makes up the eight ribs that support the trapezoidal glass system. The choice of trapezoidal rather than triangular glass helped the team keep the cost of the project down. Novum's ECG-System (edge-clamp glass) holds the glass at its edges with a minimum of clamping devices. Each glass panel was then sealed to adjoining panels with silicone caulk over a ¾" joint. "Most domes can really thrust outward when they are loaded, or you can contain that thrust within the dome itself, and that's what we did," says Collins. "The whole dome is basically supported at eight locations, which is quite something."

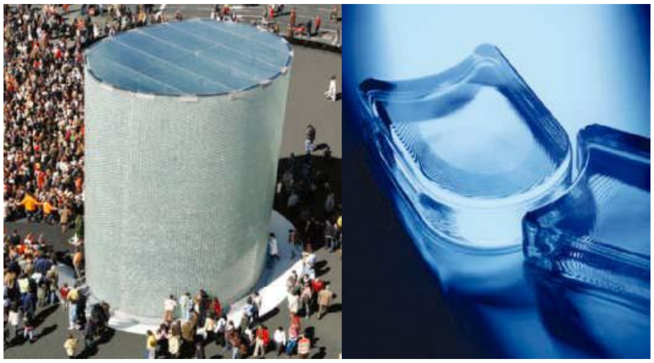
Novum's three main facilities collaborated together on the dome: It was engineered in Germany, fabricated and project-managed in Wisconsin, and a China facility provided the glazing system and some of the connectors. Harrah's opened the pool area Memorial Day weekend—15 months from conception to completion. The fast schedule, desired by the casino client, was only possible due to the close collaboration between all of the design partners, says Collins. "To do something that big in 15 months, you need to have a lot of cooperation." Novum Structures, Menomonee Falls, Wis. www.novumstructures.com **CIRCLE 223**

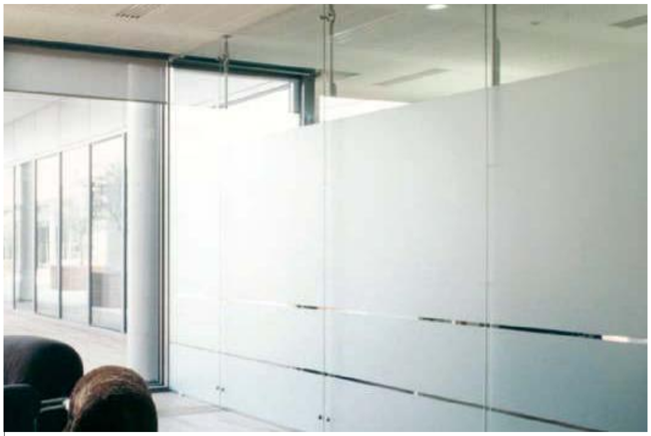
For more information, circle item numbers on Reader Service Card or go to architecturalrecord.com/products/.

Products Glass & Glazing

▼ Custom glass blocks clad memorial

Schott supplied the 15,600 glass blocks for the memorial that opened last March in Madrid (below) to pay tribute to the victims of the 2004 train bombings, the worst terrorist attack in Spain's history. Designed by Estudio FAM and made of borosilicate glass, the blocks were manufactured with curved ends, convex on one side, concave on the other (below right). This made it possible to bond them together in circular rows of blocks to create the monument's cylindrical shape. The tempered float glass on the monument's roof was also supplied by Schott. Schott N.A., Elmsford, N.Y. www.us.schott.com **CIRCLE 224**





▲ Movable glass partitions

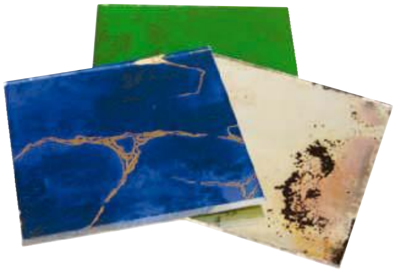
Luconi, a leading pressure-fit systems manufacturer, launched in the U.S. market at the beginning of the year. The Osso system (above) is characterized by an aluminum bar feature that has the double function of supporting glass panels and pieces of furniture. The extruded aluminum rod stands securely, either by putting pressure between the floor and ceiling or as a self-supported unit in some configurations. Luconi also offers Simple, a new double-glazed partition system that is fully sound-rated. Luconi USA, Beverly Hills, Calif. www.luconi-usa.com **CIRCLE 225**

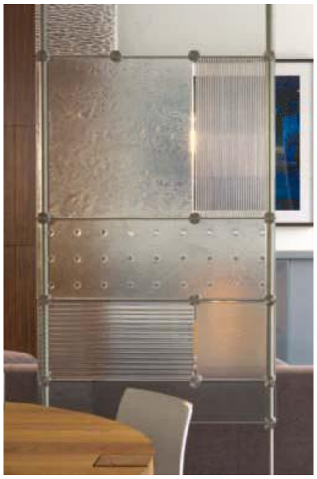
► Blast-resistant curtains

For the $50 million renovation to the Zorinsky Federal Building in Omaha, Wausau Window and Wall Systems engineered and fabricated 49,305 square feet of blast-mitigating exterior curtain wall plus an additional 18,970 square feet of interior curtain wall for the building. The exterior utilizes Wausau's SuperWall system and four-sided factory-glazed unitized system, both with 1.25" protective glass. Wausau Window and Wall Systems, Wausau, Wis. www.wausauwindow.com **CIRCLE 226**

► Reflections on the past

Jockimo's new MirrorUnique specialty glass combines a centuries-old technique for antiquing mirrors with current technologies. All MirrorUnique products are handmade in North America by local artisans. Jockimo is able to supply custom colors, safety glass (either tempered or laminated), leaded and insulated panels, and custom fabrication (holes, notches, etc.). The glass is available in a range of thicknesses and sheet sizes. Jockimo, Newport Beach, Calif. www.jockimo.com **CIRCLE 227**





◄ Modular privacy screen

Screen is a new art-glass partition by renowned glass artist, designer, and manufacturer Joel Berman. Ideal for open spaces in hospitality, office, and residential applications, the modular partition is designed to stand vertically in rooms with 8' to 9' ceilings. The unit secures in place by adjusting the fixing plates tightly against the floor and ceiling like a mechanical brace or secured to floor joists and ceiling supports with screws. A single unit features nine panels in various textures. The system can be customized to support shelves or a flat-screen monitor. Joel Berman Glass Studios, Vancouver. www.jbermanglass.com **CIRCLE 228**

◄ Good to see you again

Available in 110" x 49" slabs, Bio-Glass is made from 100 percent recycled glass and is recyclable. The material can be used for countertops or worktops, interior flooring, or walls. The glass has a multidimensional appearance and its coloring varies with direct and indirect light. The white and light-green slabs (left) are made of 100 percent postindustrial recycled content, while the brown slabs are made of 100 percent post-consumer recycled content. The material is offered in polished, honed, and natural finishes. Slabs are listed beginning at $50 per square foot. Coverings Etc, Miami. www.coveringsetc.com **CIRCLE 229**

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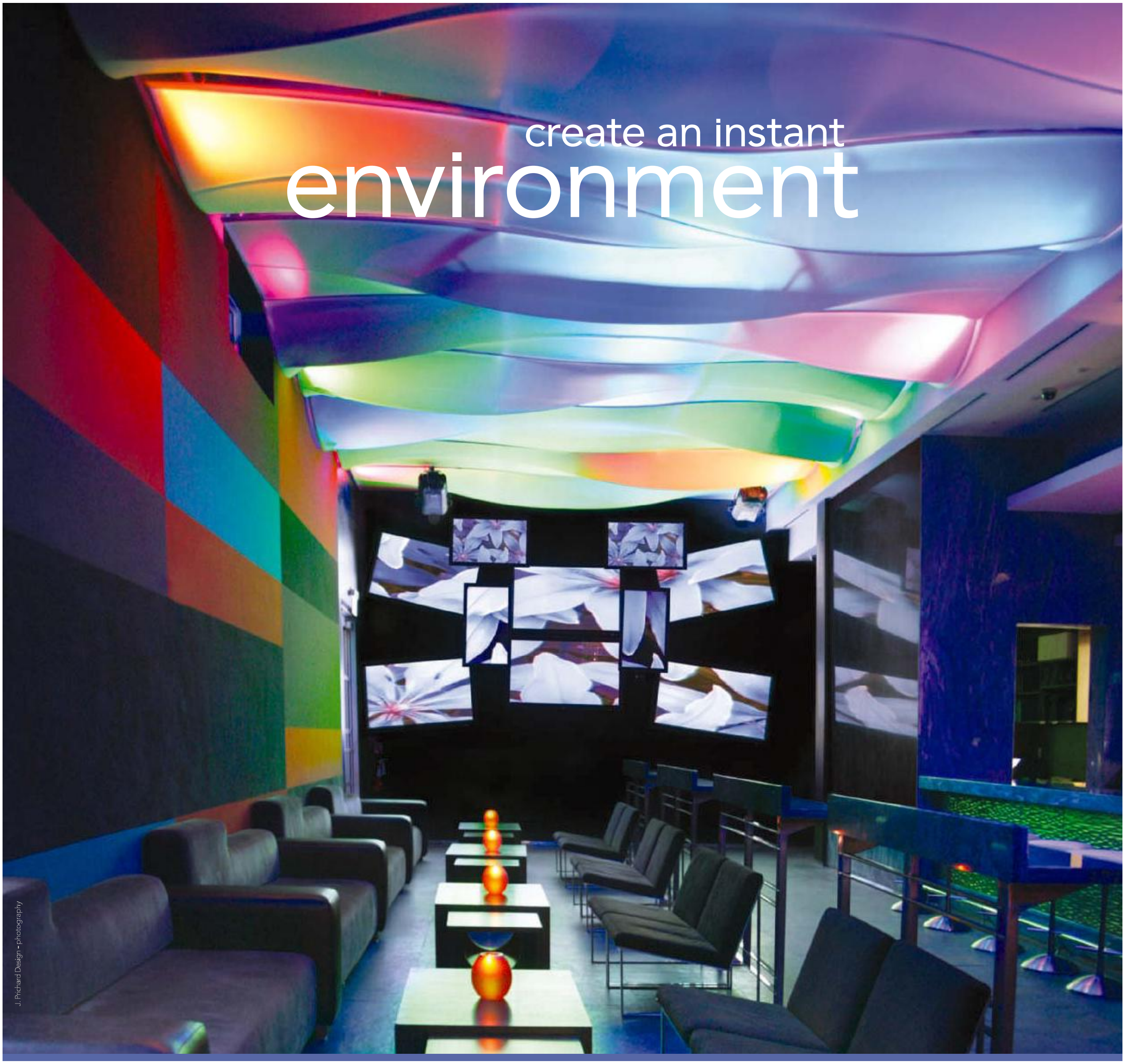

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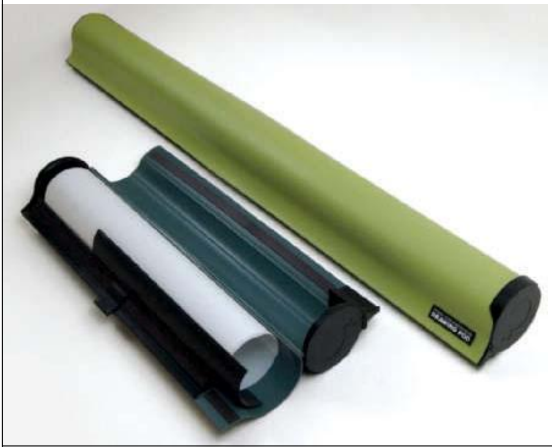
Samar Jodha / Spectra Maxima

Product Briefs

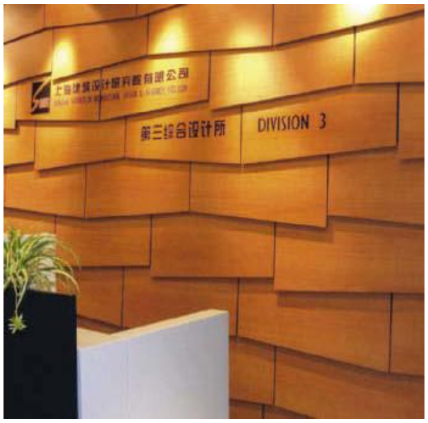
▼ Another must-have pod

Created to ameliorate the hassles of transporting important drawings (both CAD and charcoal), The Drawing Pod tackles its competition from the side. The award-winning Pod utilizes a lengthwise system for opening and closing the tube to prevent rolled documents from unwinding against the Pod's inner walls, making them difficult to retrieve. Available in both compact and regular sizes, the tube can accommodate documents from 18" to 36" wide, and even features a self-adjusting shoulder strap to ensure an ergonomic fit. From Concentrate, Cambridge, Mass. www.from-concentrate.com **CIRCLE 230**



► Interior and exterior panels

Trespa's durable panels are ideal for cladding systems with highly customizable color choices. Akin to hardwood in terms of stability, the panels are created using environmentally friendly thermosetting resin reinforced with 70 percent wood fibers under high pressure and temperature. The result is a nonporous composite panel available in an extraordinary spectrum of colors, patterns, and finishes for both interior and exterior use. Due to their impervious surface, the panels are incredibly effective as outdoor rain screens as well as indoor hygienic cladding. The Athlon line is cut and arranged like a wood-shake facade in the reception area of the Shanghai Institute of Architectural Design and Research, in Shanghai, China (right). Trespa N.A., Poway, Calif. www.trespa.com **CIRCLE 231**



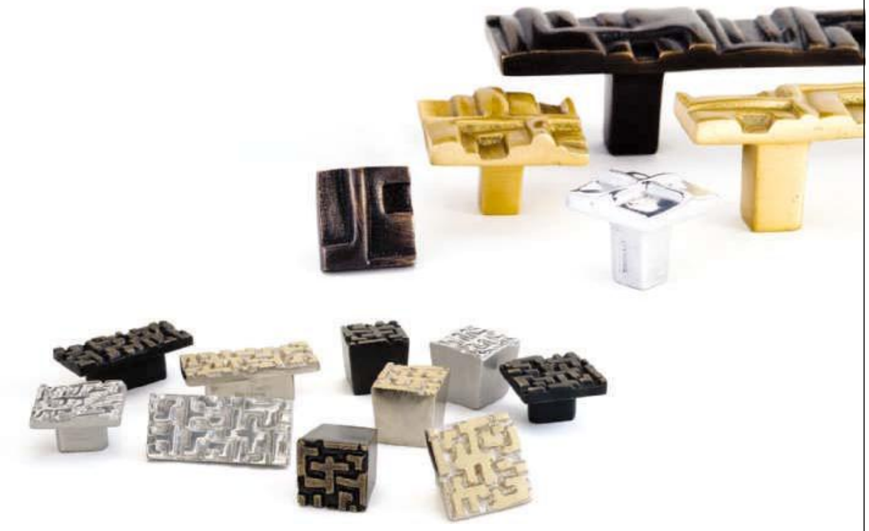
SHEETROCK
Gypsum Panel
Mold Tough

◄ Moldproof gypsum

USG recently launched a line of moisture-free gypsum panels boldly named Mold Tough. This addition to the Sheetrock line is the first gypsum panel to quell mold spores through an inventive manufacturing process that protects the panel's interior and exterior from moisture. Designed specifically for interior areas, the moisture-inhibiting panels protect materials from plumbing leaks and flooding, earning a mold-resistance score of 10 under ASTM D3273 guidelines. According to USG, Mold Tough panels are easy to score and snap, and nearly effortless to install. USG, Chicago. www.usg.com **CIRCLE 232**

▼ The Iron Age revisited

Irish designer Clodagh lends her talents to the Du Verre Hardware collection to create two striking new additions. The Kuba (bottom) and Primitive lines are the offspring of the union, and both showcase Clodagh's rich use of materials and penchant for abstract tribal motifs. Also new is the Rio series (below) by Gina Lubin, founding partner of Du Verre hardware. These exotic additions are sand-cast from brass, aluminum, and iron, and are available in a number of distinctive finishes. Maintaining a fabrication process that gives each piece minor variations, Du Verre's new lines offer the look of ancient forging. Du Verre Hardware, Toronto. www.duverre.com **CIRCLE 233**



◄ Expressionistic vinyl

InPro's new Sanparrel Expressions line makes its durable rigid vinyl sheets available for dynamic graphic styles. With the new Expressions label, the hundreds of colors, patterns, and thicknesses available in InPro's wall-protecting vinyl can be cut to custom design and shapes, enlivening any civic space. Also, InPro's sheets do not contain any plasticizers and therefore do not harm indoor air quality. With its possibilities for custom colorful graphics, the new Expressions line can be used in schools or hospitals where designers can forgo institutional monochrome for something more whimsical. InPro Corp., Muskego, Wis., www.inprocorp.com **CIRCLE 234**

► Feel the heat

Offering the most comprehensive floor-warming system on the market, Laticrete's FahrenHEAT thermal wiring is ideal for both residential and commercial projects. The FahrenHEAT system is easy to install, as it requires no dangerous near-wire stapling or nailing. The mat's self-adhesive mesh keeps it in place, and the low-profile wiring makes it virtually undetectable beneath hard tile flooring. Aside from its D.I.Y.-friendly adhesive, convenient sizes, and user-friendly thermostat, each FahrenHEAT mat comes with project layout software and online guides to make installment manageable for homeowners and builders alike. Laticrete, Bethany, Conn. www.laticrete.com **CIRCLE 235**

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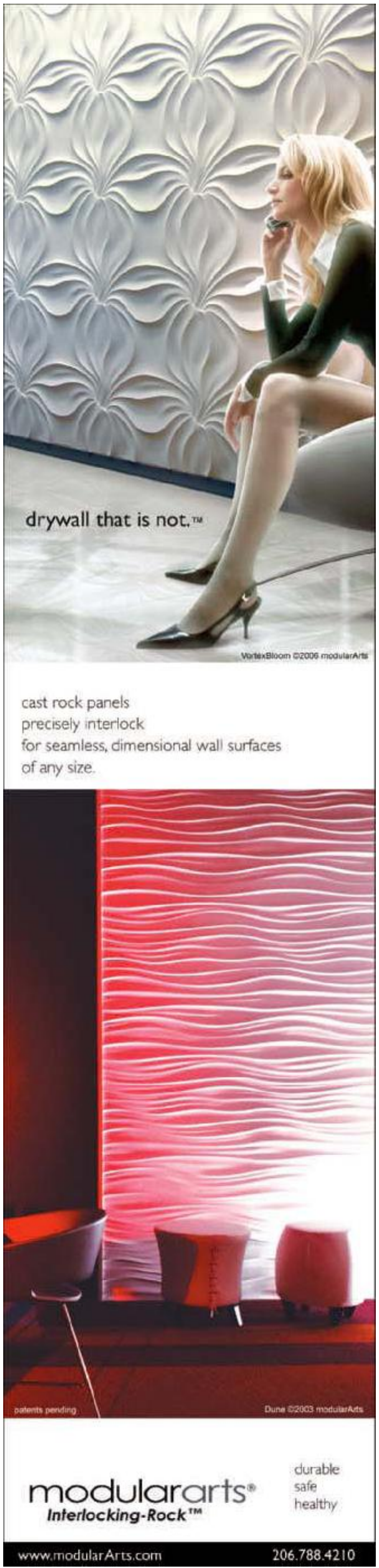

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Product Resources Literature

Schoolhouse's textbook

Schoolhouse Electric has released a new catalog with prices and dimensions of its prewar-inspired light fixtures. Ninety-five percent of the Schoolhouse line uses hardwired, energy-efficient GU24 technology—making it the most LEED-friendly selection of period lighting available. Schoolhouse Electric, Portland, Ore. www.schoolhouseelectric.com CIRCLE 236

Powers Fasteners tome

The latest updates in anchor technology, codes, and approval listings abound in Powers Fasteners' 5th edition *Specification and Design Manual*. The 390-page volume is a resource for architects and engineers in search of anchor products, MSDS sheets, and software. Powers Fasteners, Brewster, N.Y. www.powers.com CIRCLE 238

Surmounting your hang-ups

Peerless Industries' 2007 professional-grade audio/visual mount catalog features an easy-to-navigate index and thorough guide. Aside from its 15 new products, the up-to-date catalog also introduces an icon-based accessory section for convenient browsing. Peerless Industries, Chicago. www.peerlessmounts.com/catalog CIRCLE 237

Revamped lighting guide

Cooper Industries introduced its comprehensive catalog of specification-grade interior and exterior luminaries from its subsidiary Shaper Lighting. The 525-page catalog includes a new icon system for easy navigation, new Energy Star Rating details, and new products and finishes. Cooper Lighting, Peachtree, Ga. www.cooperlighting.com CIRCLE 239

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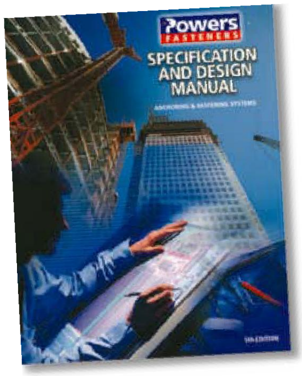
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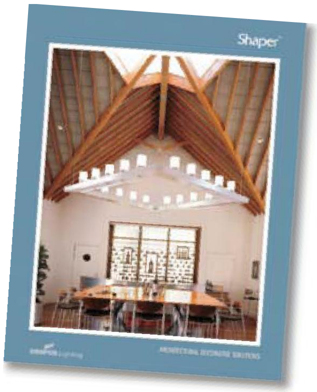

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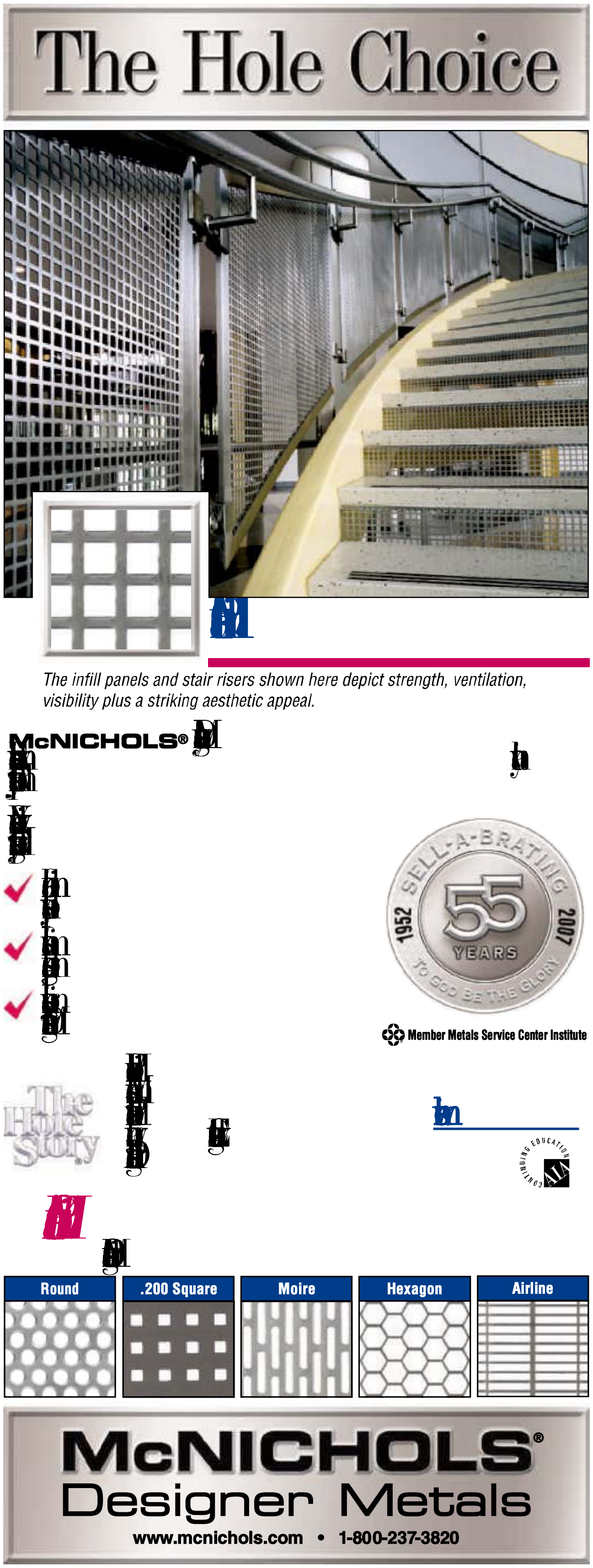

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Product Resources On the Web

www.hessamerica.com

The Web site of Euro lighting label Hess elegantly arranges its American products under a clean interface. Pop-up side menus guide buyers to product specifications, multi-angle photographs, technical drawings, and even catalog-page PDFs. Aside from the firm's familiar lighting, the Web site also showcases its range of other products, such as benches, litter receptacles, bike racks, and railing systems. In addition, the Web page offers more than 300 reference photographs of its products on-site in projects across North America and Europe.

www.jeld-wen.com

Boasting the largest selection of custom wood window drawings and product specifications online, Jeld-Wen's Web site is undeniably massive in scope—perhaps even to a fault. It is overrun with a glut of options and images for architects, builders, and homeowners alike, yet the search process is often labyrinthine and lacks a smooth interface. Nonetheless, its product listings are virtually inexhaustible, offering prospective buyers the opportunity to browse a number of styles, finishes, and hardware types.

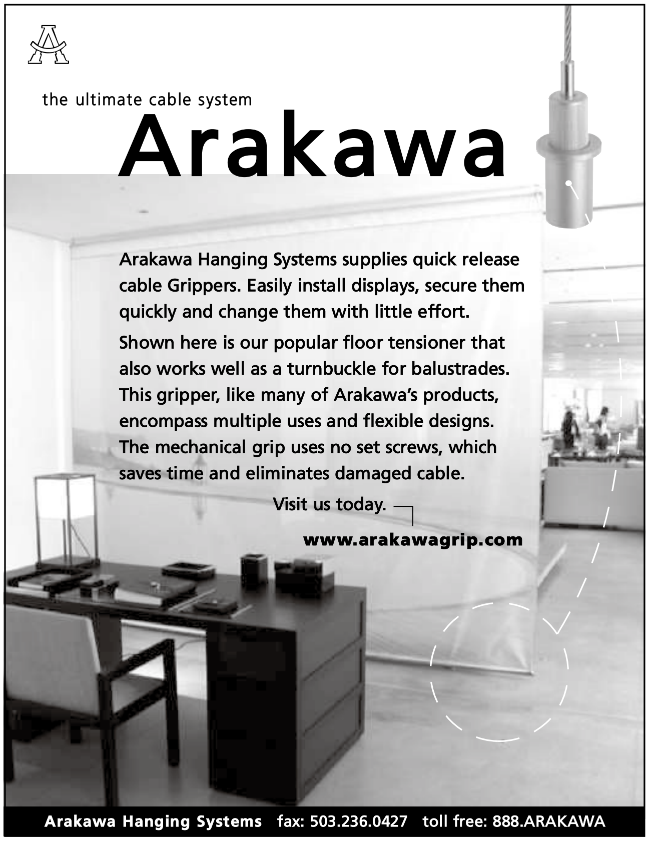
Respect the food.

www.sub-zero.com
www.wolfappliance.com

Sub-Zero and Wolf Appliance—celebrity names in the gourmet kitchen industry—fuse their legendary products into a glossy shared Web site. While it often hiccups as a result of massive flash videos and demos, the site is easy to navigate and highly interactive. Buyers can browse a range of customizable options and color palettes to help them visualize their dream kitchen. And with a bevy of product measurements, photos, and informational videos, the site makes it that much more attainable.

www.bendheimcabinetglass.com

The words "Your home. Your vision" welcome visitors to the remarkably user-friendly Bendheim Cabinet Glass site, which makes said vision lucid through its online resources. The site offers measuring tips and a helpline number for D.I.Y. soldiers, as well as an online catalog that's easy to browse. Interested buyers simply select search criteria (various types and styles) and sift through resulting options. Aside from obtaining detailed specifications of glass sizes and prices online, prospective customers can also order 2 ⅝" x 5" samples for $3.



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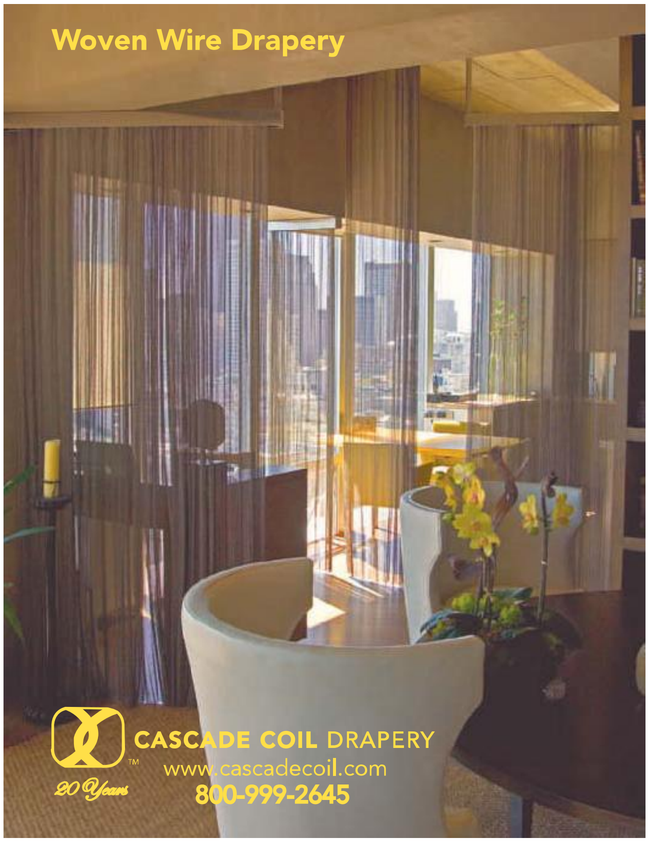

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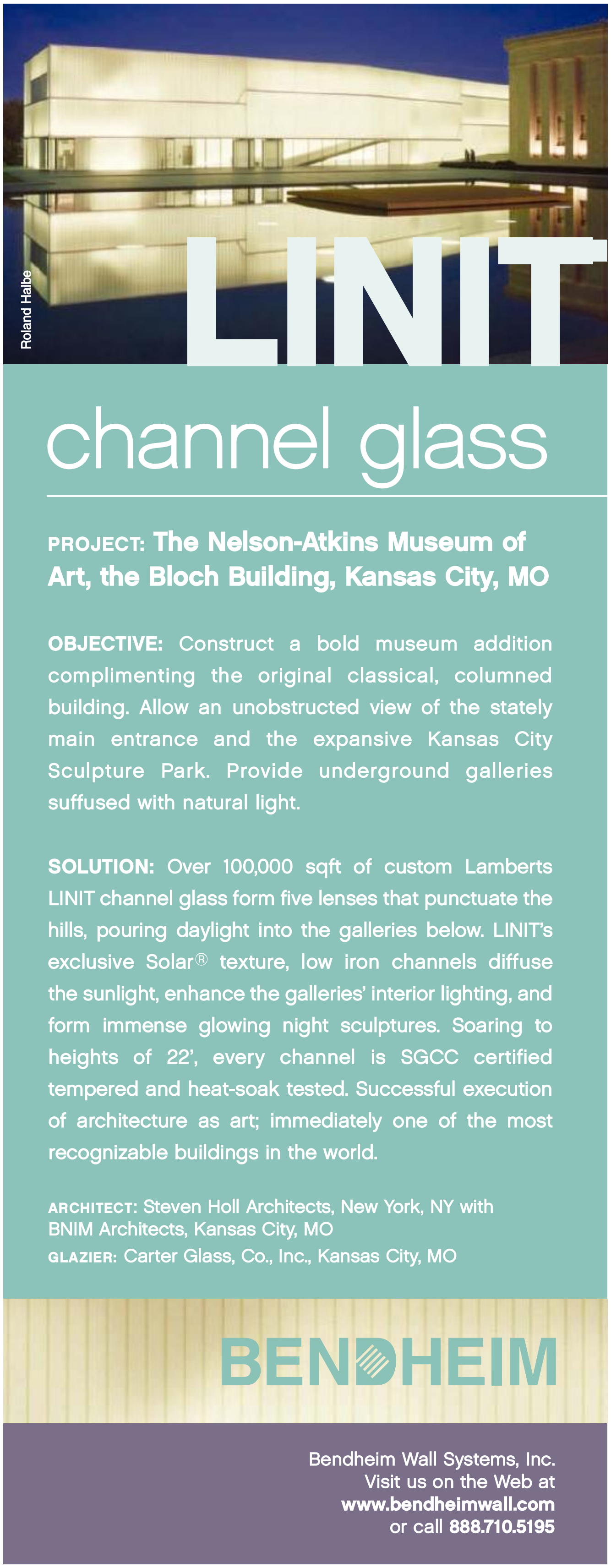

Roland Halbe

LINIT

channel glass

PROJECT: The Nelson-Atkins Museum of Art, the Bloch Building, Kansas City, MO

OBJECTIVE: Construct a bold museum addition complimenting the original classical, columned building. Allow an unobstructed view of the stately main entrance and the expansive Kansas City Sculpture Park. Provide underground galleries suffused with natural light.

SOLUTION: Over 100,000 sqft of custom Lamberts LINIT channel glass form five lenses that punctuate the hills, pouring daylight into the galleries below. LINIT's exclusive Solar® texture, low iron channels diffuse the sunlight, enhance the galleries' interior lighting, and form immense glowing night sculptures. Soaring to heights of 22', every channel is SGCC certified tempered and heat-soak tested. Successful execution of architecture as art; immediately one of the most recognizable buildings in the world.

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GLAZIER: Carter Glass, Co., Inc., Kansas City, MO

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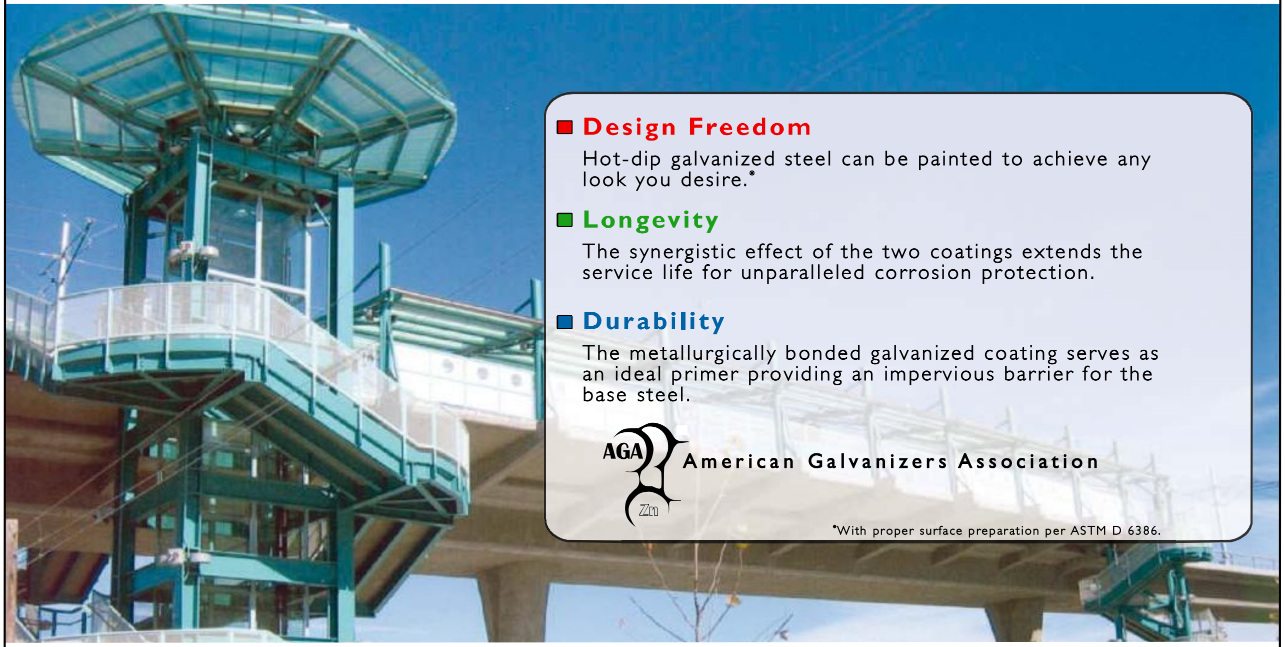

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American Institute of Architecture Students

The AIAS serves as the incubator for the architecture profession and its many related organizations. By joining the AIAS, members are expressing interest in the profession and in their future. Our leadership development activities provide significant opportunities for students to advance their skills while encouraging them to become engaged members of the profession as well as leaders in industry, in their communities and in society. Many AIAS alumni have served and continue to serve as leaders in the profession and their communities today.

Through the development of AIAS Emerging Leader Initiatives, our members impact society by strengthening and developing unique community outreach programs. The AIAS fosters future generations of professionals who are prepared to take active leadership roles in the profession and in industry, and who are ready to address critical societal matters. As involved citizens, leaders and policy makers on local, national and global scales, these future leaders will be addressing needs for healthy and sustianably designed buildings and communities, and will be dealing with issues such as affordable housing, mass transportation, and universal design.

For more information on becoming involved with future generations of professionals, please visit www.aias.org.

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The AIAS is an independent, non-profit, and student-run organization that is the sole official student voice in the profession.

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Dates & Events

New and Upcoming Exhibitions

Me, Myself & Infrastructure: Private Lives and Public Works in America
Chicago
August 8–November 16, 2007
Featuring a New York coffee shop, a comfortable living room, a city bus stop, and a "big box"–type store, this exhibition invites visitors to explore how their decisions—whether it's buying a home in a new subdivision or shopping at Wal-Mart—shape the built environment. At the Chicago Architecture Foundation. Call 312/922-3432 or visit www.architecture.org.

California Design Biennial 2007
Pasadena
August 18–September 30, 2007
This exhibition is a juried selection of the most original and important design produced in California over the past two years and is the only show that highlights the unique achievements of California designers. Fashion, furniture, transportation, consumer products, and graphic design will be on display—all selected by a jury of renowned design professionals. At the Pasadena Museum of California Art. Call 323/936-1447 or visit www.caapr.com.

Lectures, Conferences, and Symposia

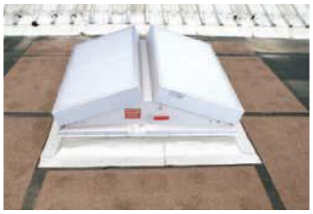
Is Efficiency Good Enough?
Chicago
August 14, 2007
A public program with Helen Kessler, FAIA, HJKessler Associates. At the Chicago Architecture Foundation. Call 312/922-3432 or visit www.architecture.org.

The 2007 Western Mountain Region Conference: Dreamscapes to Greenscapes
Incline Village, Nevada
September 12–16, 2007
The conference will promote sustainable design and energy conservation in the region. Featured speakers will be Edward Mazria, founder of Architecture 2030, and R.K. Stewart, the national president of AIA. The conference will include an exclusive green trade show and expo with demonstrations. At the Hyatt Regency Resort. For further information on expo booths, call 775/827-4441. For more about the WMR conference, visit www.aiann.org.

Dwell on Design Conference + Exhibition: Building Community in the Modern World
San Francisco
September 14–16, 2007
All aspects of the built environment will be included, from urban redevelopment projects to co-housing and single-family dwellings, farmers markets to public art programs, as well as diverse social and economic interactions that define the world in which we live. A hands-on marketplace will demonstrate top products and services inspired by modern design. At the Concourse Exhibition Center. Visit www.dwellondesign.com.

Competitions

Schedium: The Art of Drawing in the Age of Digital Architecture
Deadline: August 31, 2007
An international call for entries to submit portfolios celebrating the drawing abilities of today's



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Energy costs around the world are rising. Even the slightest increase in electric prices causes the operating costs for a typical building to rise. Fortunately, with the implementation of a proper daylighting design, building owners can save up to 75% of the energy used for lighting a building. Turning off or dimming lights when not needed can also save 10% - 20% of the energy used to cool a building. Installing Bilco's Lumivent® fire vents will vent smoke, heat, and noxious gases in the event of a fire as well as allow natural lighting to illuminate warehouses, manufacturing plants, and other facilities with large expanses of unobstructed space and further reduce energy costs.

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emerging architects. For more information, visit www.schedium.org.

Portland Courtyard Housing Competition: Creating Spaces for Families, Community, and Sustainability in the City

Deadline: October 24, 2007

This competition will explore possibilities provided by housing oriented to shared courtyards as an additional infill housing type for Portland, Oregon. Architects, landscape architects, builders, developers, students, and others interested in the competition are eligible. Multidisciplinary teams are encouraged. Visit www.courtyardhousing.org.

Self-Sufficient Housing/ The Self-Fab House: 2nd Advanced Architecture Contest

Registration Deadline: September 17, 2007

An international summons to architects, designers, and students from around the world, inviting proposals for the construction of self-sufficient dwellings with an emphasis on exploring people's capacity to construct their own homes. Visit www. advancedarchitecturecontest.org.

AIA150

The American Institute of Architecture Students' (AIAS) 2nd Annual National Student Design Competition

Deadline: November 5, 2007

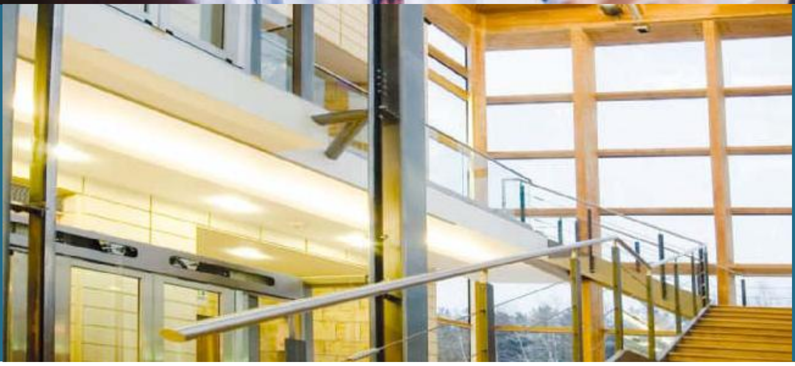
Developed for advanced students, this competition will challenge participants to design a pediatric outpatient rehabilitation center and family support facility utilizing architectural aluminum building products and systems. For more information, visit www.aias.org/kawneer.

Palladio Awards

Deadline: November 15, 2007

This program recognizes individual designers and/or design teams whose work enhances the beauty and humane qualities of the built environment through creative interpretation or adaptation of design principles developed through 2,500 years of the Western architectural tradition. Call 718/636-0788 or visit www.palladioawards.com.

E-mail event and competition information two months in advance to elisabeth_broome@mcgraw-hill.com.



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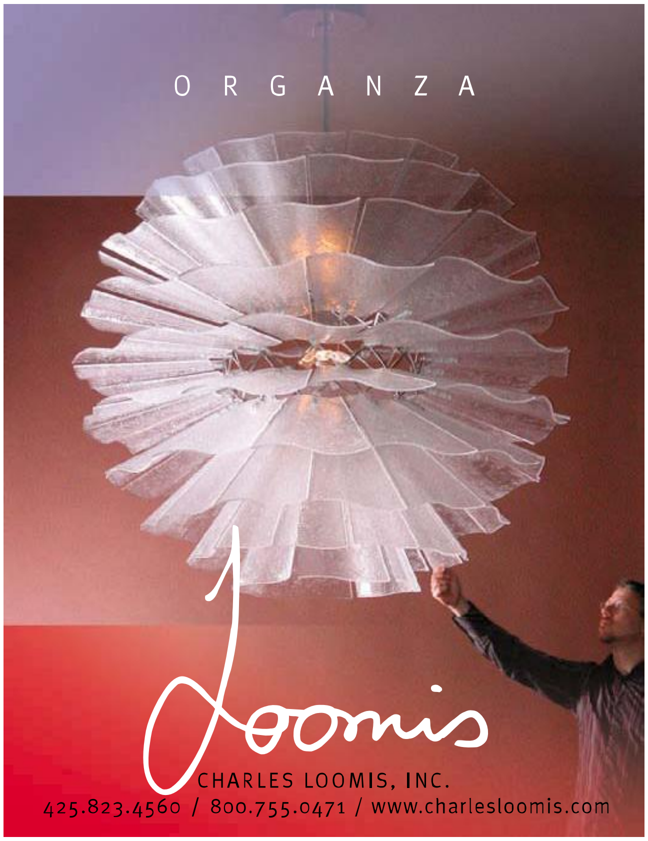

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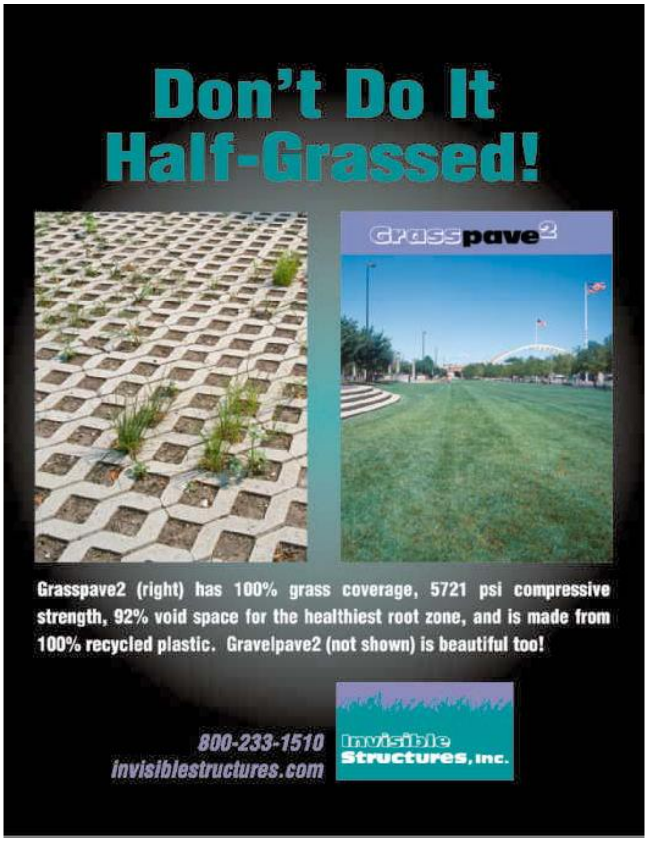

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Call (800) 523-1269 or visit mockett.com for more details.

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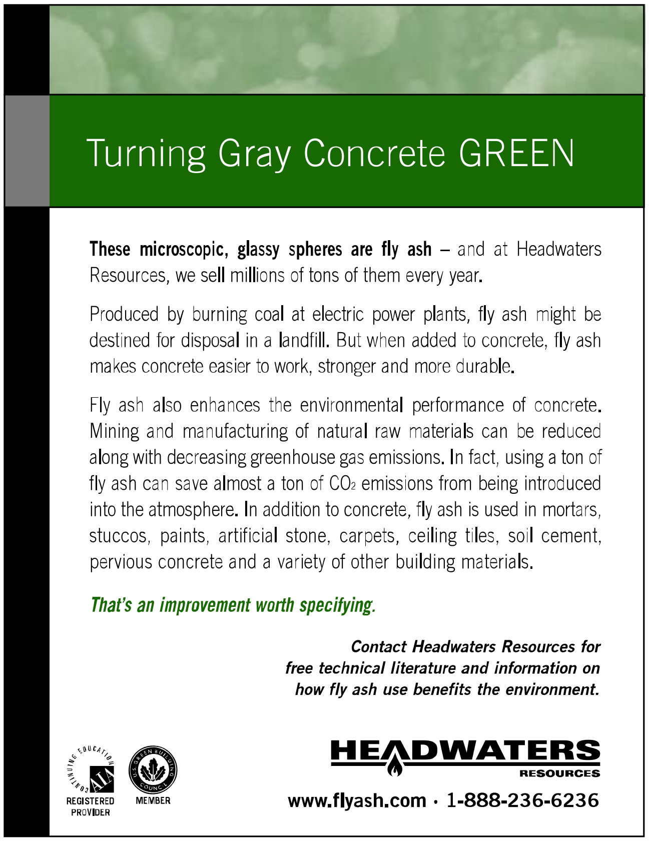

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American Institute of Architecture Students

Life safety, dignity and comfort are the foundation of and the reason for Freedom by Design™. Freedom by Design is an AIAS-led program that utilizes the talents of architecture students in service to their communities by helping individuals with physical challenges. FBD provides students with the opportunity to combine design skills and with a passion for service and leadership that can radically impact the lives of individuals in need.

Minor modifications to the homes allow individuals to live safely, comfortably and with dignity by addressing their struggle with everyday tasks such as getting in and out of showers, ascending stairs, or egress to the home itself.

Through its 130 chapters, the AIAS is implementing a program that involves students resolving accessibility issues, and simultaneously provides the students with the experience of working with a client, mentorship from a local architect, and an understanding of the practical impact of architecture and design. The AIAS will continue to work diligently to place FBD and issues of universal design and community service in the national spotlight.

You are invited to get involved. The AIAS is seeking mentors and supporters to help us grow this important program. Please help us help others. To learn more, visit www.aias.org/freedom.

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"What do we live for, if it is not to make life less difficult for each other?"

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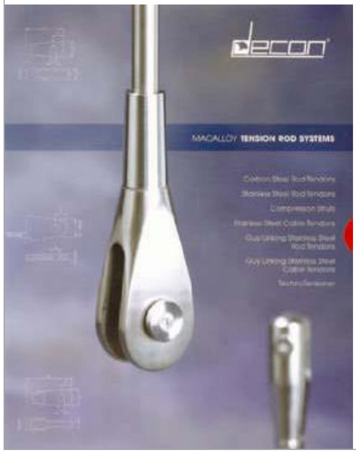

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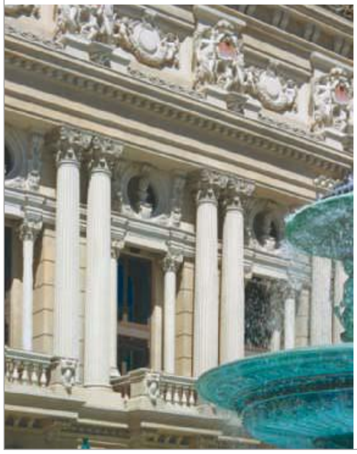
Columns, Balustrades & Cornices

Melton Classics



Melton Classics provides the design professional with the most comprehensive selection of quality architectural products in the industry, including architectural columns, balustrades, mouldings, cornices, and a wide array of architectural elements. Architectural columns are available plain or fluted, load-bearing or column covers, round or square in fiberglass, fiberglass/marble composite, synthetic stone, cast stone, GFRC, and wood for paint or stain. Melton Classics offers a maintenance free balustrade product ideal for any application.

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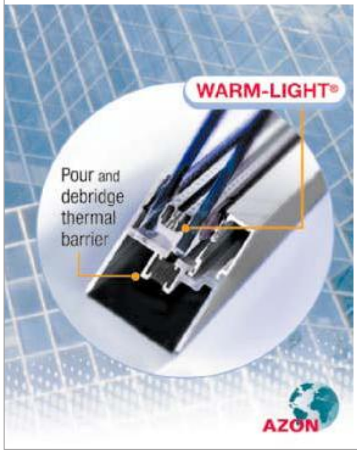

Warm-Light® spacer for insulating glass provides a more comfortable interior environment, reduces thermal conductivity and condensation on the glass surface while lowering utility costs. Azon is the global leader in developing technology for the manufacture of thermal barrier aluminum fenestration, commonly referred to as the pour and debridge method.

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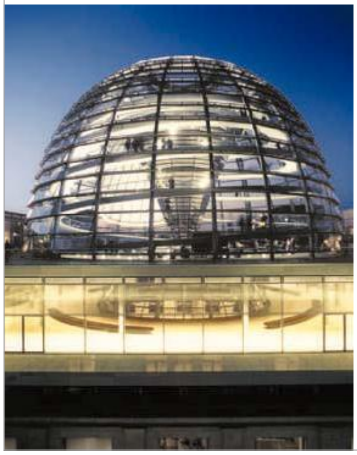

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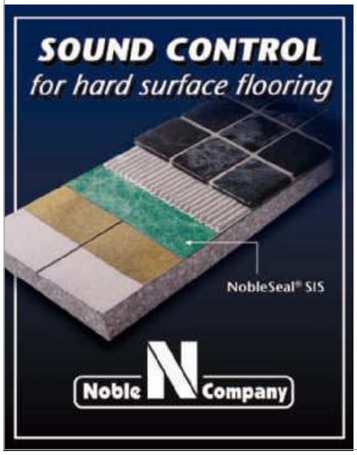

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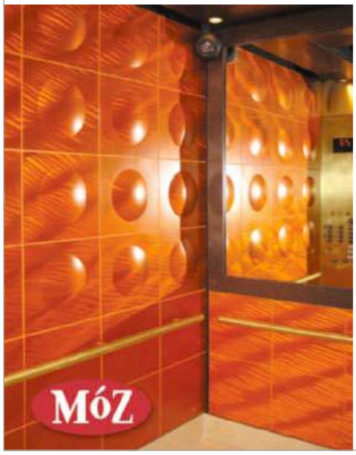

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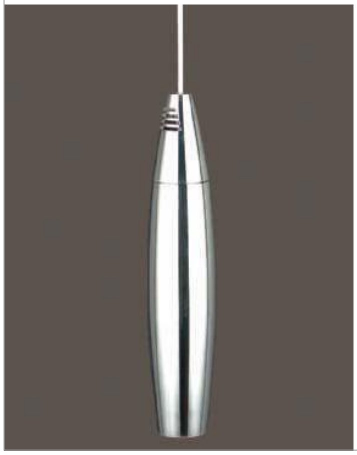

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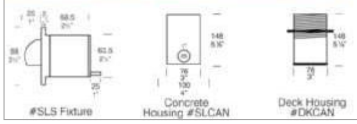

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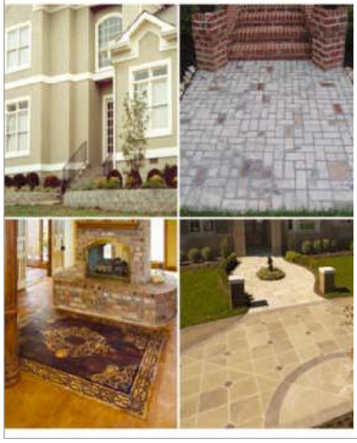

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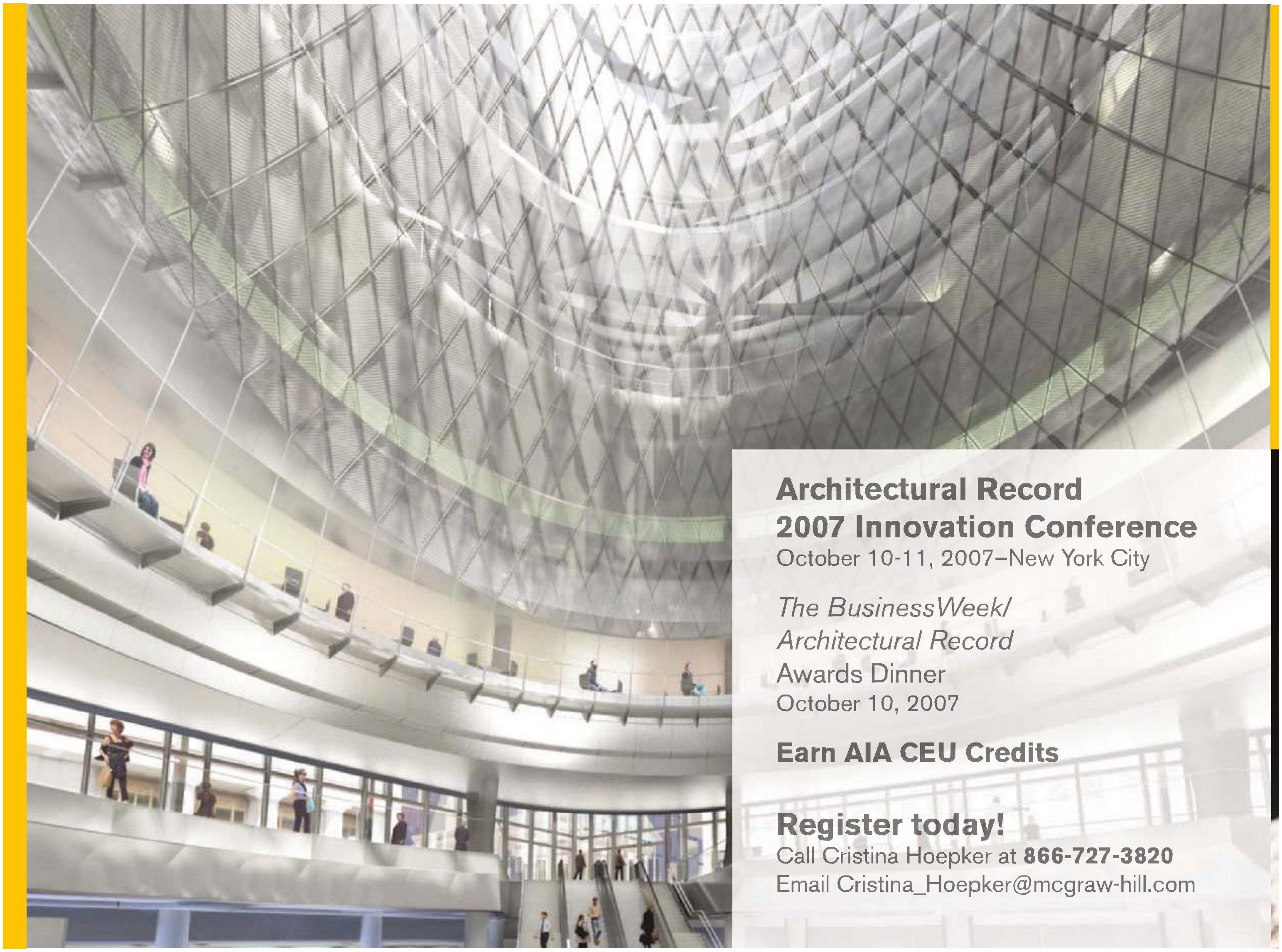

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-Branko Kolarevik, Haworth Chair in Environmental Design, University of Calgary, with Ali Malkawi, Director, Chan Center for Building Simulation and Energy Studies, University of Pennsylvania

Building Facades and Skins
-Advanced Facade Design, Marc Simmons, and Bruce Nichol, Front Inc.,
-William Zahner, president of A. Zahner Metals,

Transformative structures
-Chuck Hoberman, Hoberman Design

The Power of Design to Affect Transformation
-Gary Van Deursen, of Van Deursen Innovation and Design

Work in place: Case Studies of Innovative and High Performance Materials and Systems

Investigating the Art and Science of Glass and Light
-James Carpenter, principal of Carpenter Design Associates, and Davidson Norris, principals of Carpenter/Norris Consulting, Advanced Daylighting Systems

-Marilyne Andersen, PhD, Department of Architecture, at the Massachusetts Institute of Technology

Case Study: The Fulton Street Transit Center
-Andrew Whalley and Vincent Chang of Grimshaw Architects, with James Carpenter

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61	*38*	Ⓢ	Bobrick	*bobrick.com*
2-3	*2*		Brick Industry Association	*brickinfo.org*
19	*11*	Ⓢ	C/S Group	*c-sgroup.com/3000*
195	*78*		Cascade Coil Drapery	*cascadecoil.com*
12-13	*142*	Ⓢ	CENTRIA Architectural Systems	*centria.com*
200	*84*		Charles Loomis	*charlesloomis.com*
173	*62*		Cooper Lighting	*cooperlighting.com*
77	*47*	Ⓢ	CR Laurence Co Inc	*crlaurence.com*
192, 200	*73, 86*	Ⓢ	Doug Mockett & Company Inc	*mockett.com*
87	*51*	Ⓢ	E Dillon & Company	*edillon.com*
163	*58*	Ⓢ	Easi-Set Industries	*easiset.com*
54	*36*	Ⓢ	EFCO Corporation	*efcocorp.com*
183	*66*		elliptipar	*elliptipar.com*
192	*72*		Engineered Lighting Products	*elplighting.com*
189	*144*		Eventscape	*eventscape.net*
174-175	*63*		Gardco Lighting	*sitelighting.com*
29	*20*		Grohe	*groheamerica.com*
28	*19*	Ⓢ	Halfen Anchoring Systems	*halfenusa.com*
31	*22*		Hanover Architectural Products	*hanoverpavers.com*
cov-4	*91*	Ⓢ	Haworth	*haworth.com*
6	*5*	Ⓢ	HDI Railing Systems	*hdirailings.com*
200	*87*		Headwaters Resources	*flyash.com*
193	*75*		Horton Automatics	*hortondoors.com*
30	*21*		Indiana Limestone Company	*indianalimestonecompany.com*
185	*68*		Insight Lighting	*insightlighting.com*
200	*85*	Ⓢ	Invisible Structures Inc	*invisiblestructures.com*
46	*30*	Ⓢ	IR - Von Duprin	*vonduprin.ingersollrand.com*
4	*3*		Jack Arnold Architect	*jackarnold.com*
41	*27*	Ⓢ	Kawneer Company Inc	*kawneer.com*
168	*61*		Kim Lighting	*kimlighting.com*
49	*33*		Klai Juba Architects	*kaljuba.com*
80A-B			Kohler	*kohler.com*
180	*65*		LightingUniverse.com	*lightinguniverse.com*
24	*16*	Ⓢ	Lutron	*lutron.com*
184	*67*		Manning Lighting	*manningltg.com*
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156-157			McGraw-Hill Construction	*construction.com*
199, 215			McGraw-Hill Construction	*construction.com*
194	*76*	Ⓢ	McNichols Co	*mcnichols.com*
191	*71*		modularArts	*modulararts.com*
88	*52*	Ⓢ	Mortar Net	*mortarnet.com*
182			National Building Museum	*nbm.org*
10-11	*8*	Ⓢ	Oldcastle Glass	*oldcastleglass.com*
186	*69*	Ⓢ	Pilkington	*pilkington.com*
16, 83	*10, 49*	Ⓢ	PPG	*ppgideascapes.com*
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167	*60*		Prudential Lighting	*prulite.com*
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215	*89*	Ⓢ	Salsbury Industries	*mailboxes.com*
69	*42*		Schott Corporation	*us.schott.com*
cov-3	*90*		Selux	*selux.com/usa*
155	*56*		Simpson Strong-Tie Company Inc	*simpsonstrongwall.com*
190			Skyscraper Museum, The	*skyscraper.org*
37	*25*	Ⓢ	Sloan Valve Company	*sloanvalve.com*
48	*32*	Ⓢ	Smoke Guard	*smokeguard.com*
43	*28*		St. Paul Travelers	*stpaultravlers.com*
62	*39*		Steel Door Institute	*steeldoor.org*
201	*88*		Sugatsune America Inc	*sugatsune.com*
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85	*50*		Vista Window Film	*vista-films.com*
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136	*55*	Ⓢ	W&W Glass Systems Inc	*wwglass.com*
198	*82*		Wagner	*wagnercompanies.com*
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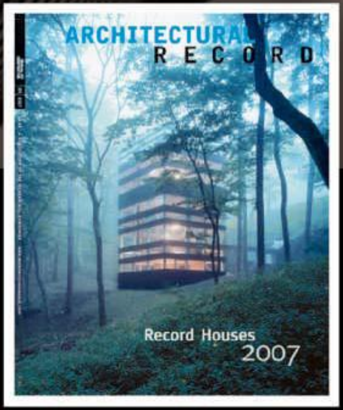

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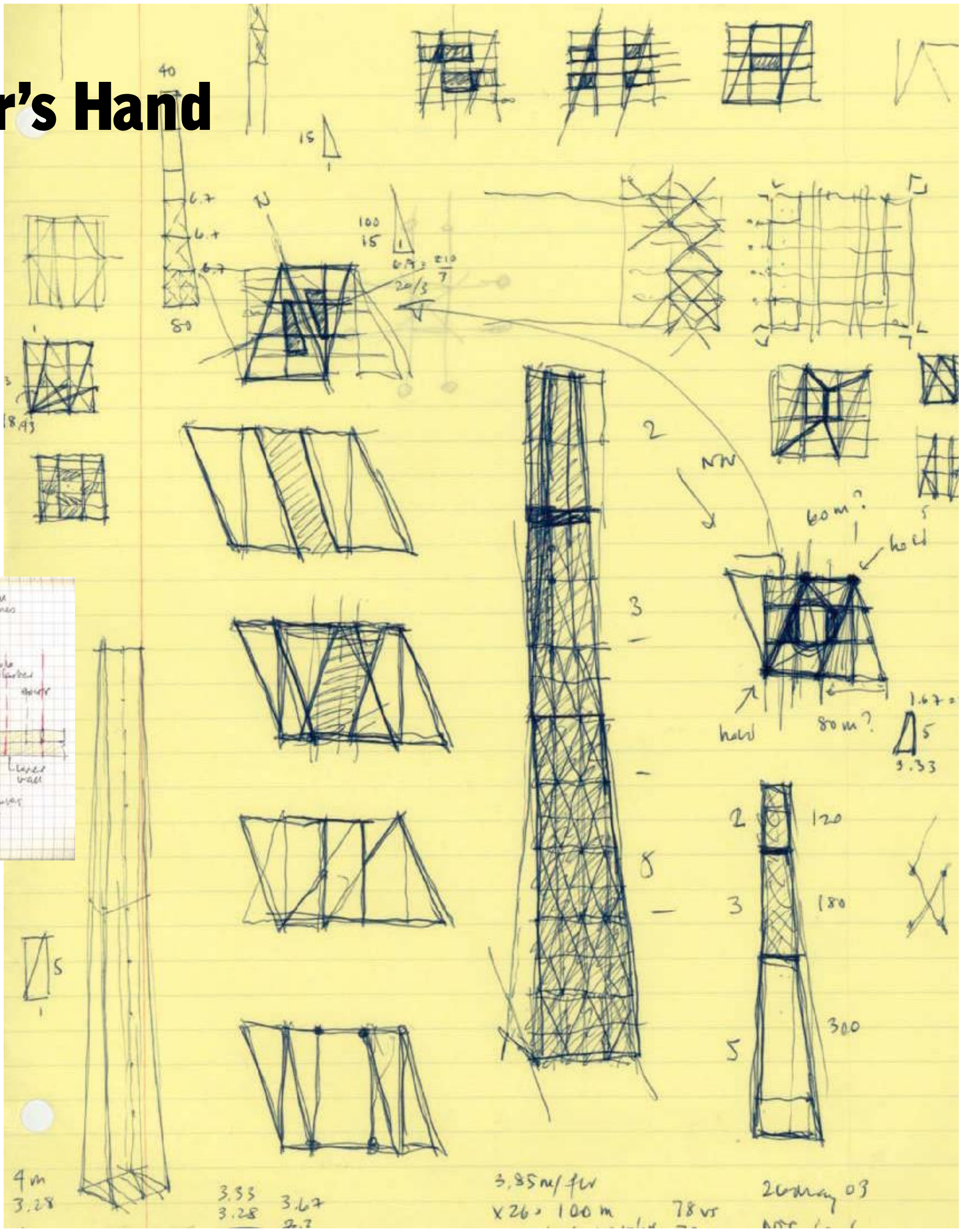

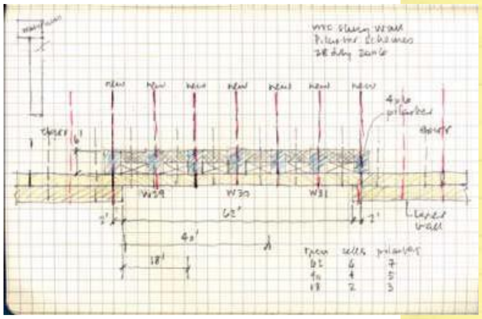

Freedom Tower at Ground Zero **(right), blue ball-point pen on yellow-ruled, 8½-by-11-inch note-board paper, 2003.** ***Slurry Wall*** **(above), colored and mechanical pencil on 5¼-by-8¼-inch sketchbook page, 2006.**

Guy Nordenson sketches to think

Guy Nordenson, a structural engineer who began his career drafting in the joint studio of R. Buckminster Fuller and Isamu Noguchi in the summer of 1976, established the New York office of Arup in 1987 and his own practice in 1997. After the World Trade Center (WTC) attacks of 9/11, he undertook structural inspections of some 400 buildings around the site and continued to provide his services with the various design deliberations that followed, including collaborating with Skidmore, Owings & Merrill on the scheme that eventually became the Freedom Tower. One of his original sketches, from 2003 (above right), now in the Museum of Modern Art's Architecture and Design collection, shows the concept for a tower that twists around a vertical core as it rises from its rhomboid site. More recently, his office, with engineers Simpson Gumpertz & Heger, designed a system of pilasters to provide support for the exposed portion of the existing slurry wall that will become part of the WTC Memorial Museum (above left). Nordenson, who always carries his sketchbook with him, says, "Drawing is the best way to trace and nudge a fledgling idea to the point where it can be tested. The drawing is the idea, where the hand, mind, and eye come together. Computer and physical models, words, and other tools are the instruments for testing and analysis, but not in my experience the generator of strong ideas." *Jane F. Kolleeny*

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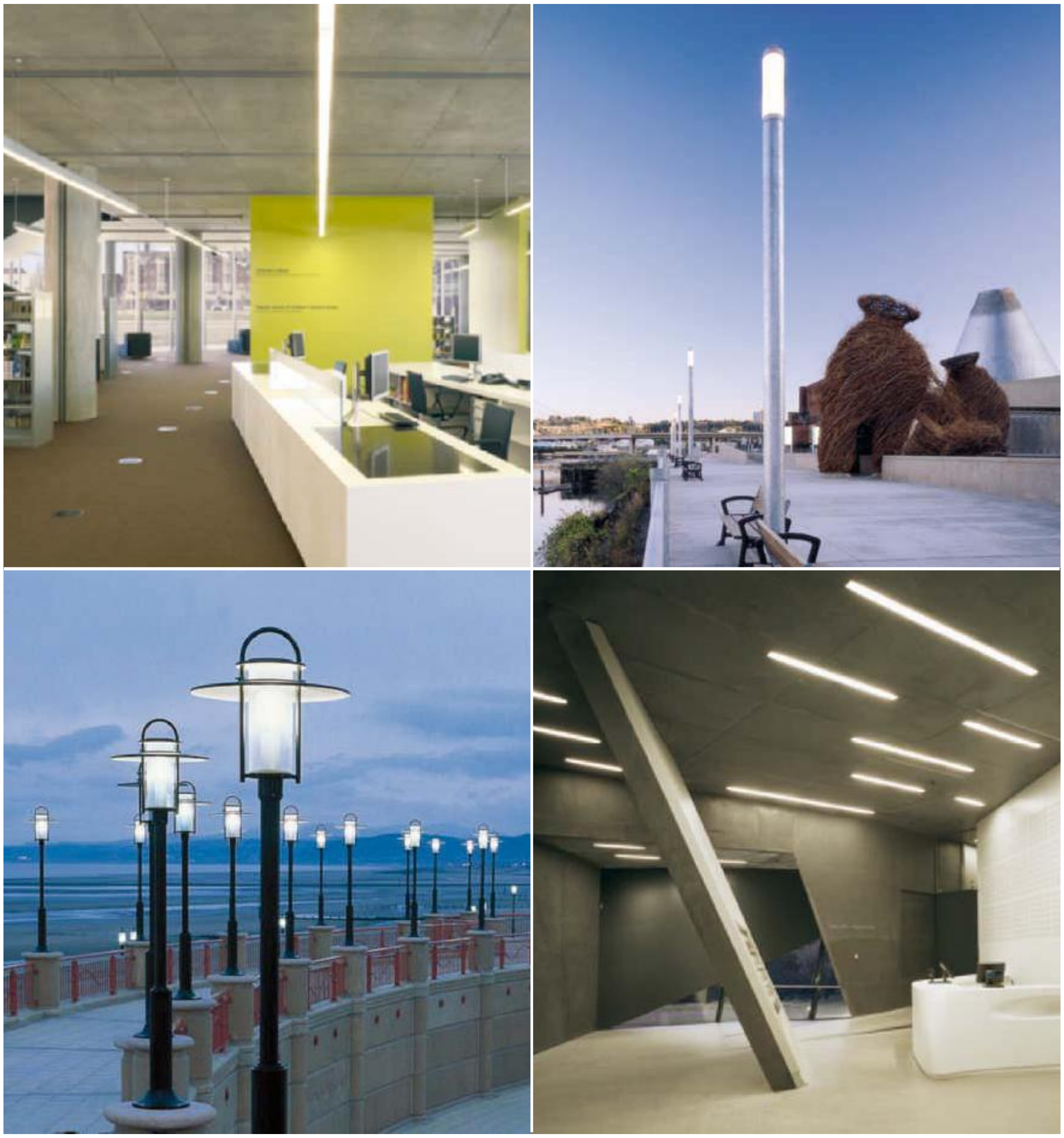

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